

# A USERS MANUAL FOR COMPUTERIZATION OF HYDROGEOLOGIC DATA FOR A RIVER ALLUVIUM

---

ARS-S-138

November 1976

Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE  
in cooperation with  
Oklahoma Agricultural Experiment Station

## CONTENTS

	Page
Abstract . . . . .	1
Introduction . . . . .	1
Data-retrieval system . . . . .	2
Graphical presentations . . . . .	10
Literature cited . . . . .	17
Appendix A.—Control-card setups, card specifications, and list of variables for options A–N . . . . .	17
Appendix B.—Formats used for data storage . . . . .	28
Appendix C.—Source listing for storage and retrieval programs . . . . .	29
Appendix D.—Source listing for hydraulic-coefficient range-assignment program . . . . .	50
Appendix E.—Flow charts and list of variables for preparing graphical presentations . . . . .	51
Appendix F.—Input cards for graphical presentations . . . . .	54

## ILLUSTRATIONS

Fig.		
1.	Hydraulic-coefficient ranges in the Washita River alluvium . . . . .	2
2.	Type and function of data processed in computer storage and retrieval system . . . . .	3
3.	Flow chart for retrieval of hydrogeologic data . . . . .	4
4.	Flow chart for retrieval control cards, A–N . . . . .	6–7
5.	Relationship between hydraulic-coefficient ranges, median grain size, and the coefficient of permeability . . . . .	10
6.	Data-retrieval system using hydraulic coefficients . . . . .	11
7.	Control cards for retrieval of data for plotting cross sections . . . . .	11
8.	Cross section near Alex, Okla. . . . .	12
9.	Control cards for retrieval of data for mapping distributions of selected hole data . . . . .	13
10.	Distribution of total depth of test holes . . . . .	13
11.	Control cards for retrieval of hydraulic-coefficient ranges at a specified subdatum . . . . .	14
12.	Map of hydraulic ranges for a specified subdatum elevation . . . . .	14
13.	Control cards for retrieval of weighted averages of the hydraulic coefficients of all layers in each hole . . . . .	15
14.	Map of average permeability coefficients . . . . .	15
15.	Control cards for retrieval of an isopachous map of lithology having permeability ranges 1–5 . . . . .	16
16.	Isopachous map of hydraulic properties, ranges 1–5 . . . . .	16
A-1.	Retrieval option A: special drill-hole data . . . . .	17
A-2.	Retrieval option B: type of material . . . . .	17
A-3.	Retrieval option C: color of material . . . . .	18
A-4.	Retrieval option D: data from specified subdatum planes . . . . .	18
A-5.	Retrieval option E: data from selected heights above bedrock . . . . .	18

	Page
A-6. Retrieval option F: data for logging a test hole . . . . .	18
A-7. Retrieval option G: data from saturated zone . . . . .	19
A-8. Retrieval option H: data from specified depths below ground surface . . . . .	19
A-9. Retrieval option I: average hydraulic coefficients for the satu- rated zone . . . . .	19
A-10. Retrieval option J: selection of all test-hole and layer data	19
A-11. Description of card types A, B, and C . . . . .	20
A-12. Description of card types D, E, and F . . . . .	21
A-13. Description of card types G, H, and I . . . . .	22
A-14. Description of card types J, K, and L . . . . .	23
A-15. Description of card types M and N . . . . .	24
B-1. Input card formats . . . . .	28
E-1. Flow charts for preparing map views and cross sections . . . .	51
F-1. Input cards for plotting cross sections . . . . .	54
F-2. Input cards for plotting map views . . . . .	55
F-3. Input-card setup for plotting cross sections . . . . .	56
F-4. Input-card setup for plotting test-hole data . . . . .	56
F-5. Input-card setup for plotting data at a specified subdatum . . .	56
F-6. Input-card setup for plotting average permeability coeffi- cients . . . . .	56
F-7. Input-card setup for isopachous maps . . . . .	56

## TABLES

1. Data-processing code for tape storage, entire well . . . . .	5
2. Data-processing code for tape storage, stratigraphic layers . . .	8
3. Lithologic type and associated range of the hydraulic coeffi- cients . . . . .	9
4. List of codes representing four groups of relative permeability .	9

# A USERS MANUAL FOR COMPUTERIZATION OF HYDROGEOLOGIC DATA FOR A RIVER ALLUVIUM

By James W. Naney, Bill B. Barnes, and Douglas C. Kent<sup>1</sup>

## ABSTRACT

A system for rapid storage and retrieval of data from a multilayered aquifer based on the hydraulic properties of the aquifer was developed. The manual consists of the data-retrieval system, control-card setups and specifications, lists of variables, formats and source listings for data storage and retrieval, and graphical illustrations demonstrating how the system works. Data for the examples were collected in the alluvium of the Washita River near Chickasha, Okla. These data were processed according to the manual to produce a lithologic cross section, an isopachous map, a specific subdatum map, a distributed test-hole-data map, and a permeability-distribution map. The system proved capable of storing and retrieving a large volume of layered hydrogeologic data, and it will have wide geographic application where hydrogeologic studies are undertaken. The system may also be adapted to other types of materials because it uses numerical coding exclusively to describe the hydrogeologic data to be stored, retrieved, and manipulated. **KEYWORDS:** computerization of hydrogeologic data, ground water, ground-water storage, ground-water transmissibility, hydrogeology, hydrology, lithology, soil permeability.

## INTRODUCTION

A layered lithologic system created the need for specialized computer programs to store, retrieve, and manipulate hydrogeologic data. Existing programs (1, 5, 7)<sup>2</sup> would store data on labeled punched cards or provide for the alphameric coding of data on punched cards and store and retrieve ground-water hydrographs. This manual, however, has been developed for the selection and retrieval of ground-water data based on the hydraulic properties of an alluvial aquifer. It documents techniques described in an earlier paper by Kent et

al. (3); excerpts from that paper are included here for convenience.

The retrieval system was applied to define boundaries and internal hydraulic characteristics of an aquifer in the Washita River alluvium near Chickasha, Okla. (fig. 1). The alluvium is characterized by several discontinuous layers of silty clay, sand, and gravel similar to those found in stratified alluvial fans, as well as some stratified basin and Coastal Plain sediments. Although the approach used in this study was specifically designed for alluvial aquifer systems, as shown by Naney and Kent (6), it can be used for other similar aquifers.

The computer codes presented in this manual are written in FORTRAN IV for the IBM 360-65 computer. Some of the techniques used for processing the data in the examples were developed on the IBM 1130. A restriction on the word length for coding some of the data was

<sup>1</sup> Geologist and computer specialist, Agricultural Research Service, U.S. Department of Agriculture, Chickasha, Okla. 73018, and associate professor of geology, Oklahoma State University, Stillwater, Okla. 74074.

<sup>2</sup> Italic numbers in parentheses refer to items in "Literature Cited" preceding appendix A.

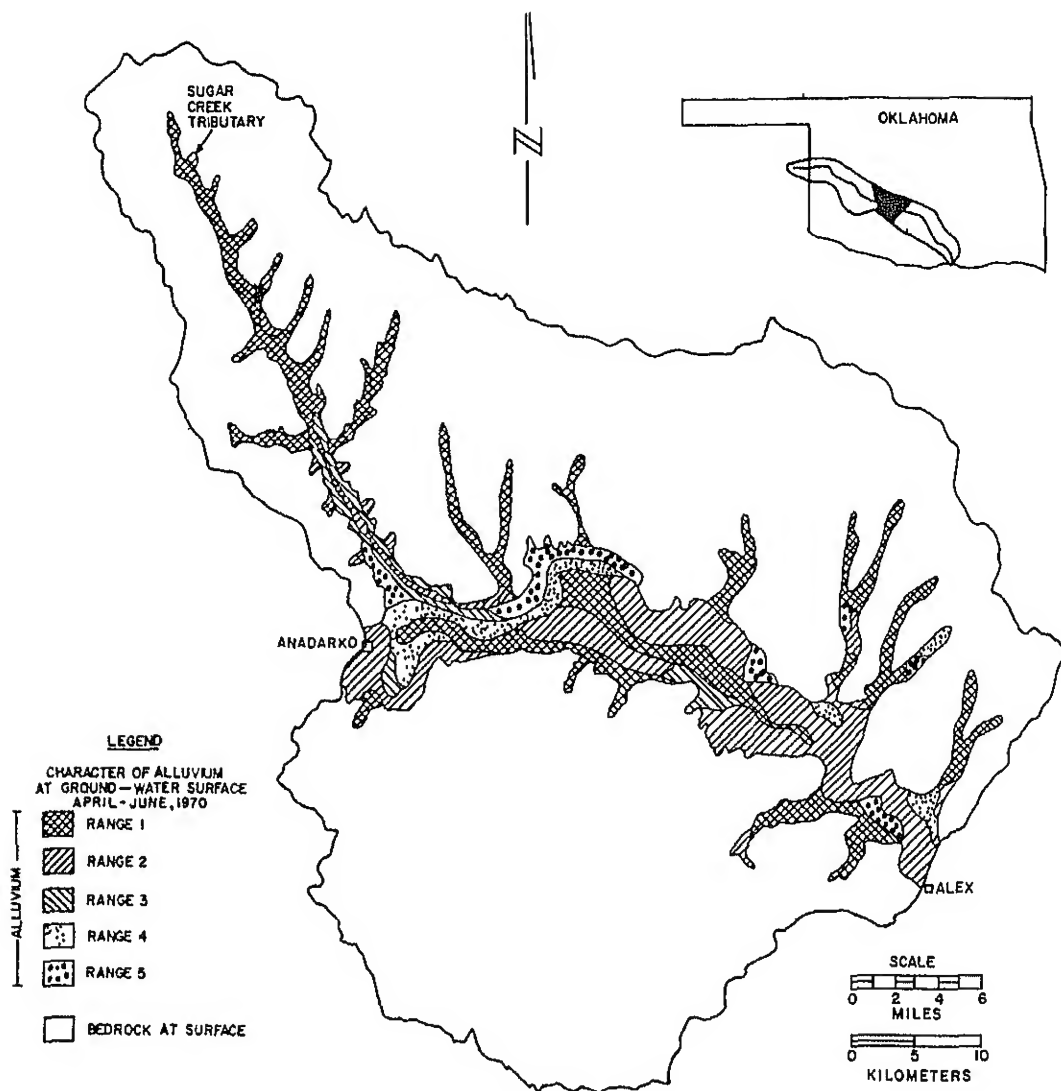


FIGURE 1.—Hydraulic-coefficient ranges in the Washita River alluvium.

encountered with the IBM 1130. The adaption of these programs to both computers, however, has expanded the availability of the technique for which this manual is written.

Three types of data are documented and stored in this data-handling system: (1) general test-hole information (test-hole data); (2) stratification characteristics (layer data); and (3) water-level records (water-level data). The test-hole data consist of the well number, location, elevation of ground surface, elevation of top of pipe (well casing), the number of layers, and the method of drilling. Layer data include layer number and thickness, method of analysis, lithologic type and color, and

approximate range of the hydraulic coefficient for each layer. The water-level data include well number, record type, date, time, and water-level elevation.

## DATA-RETRIEVAL SYSTEM

The data-retrieval system (fig. 2) is based on descriptions of the lithology in terms of the type and color of material and of the hydraulic properties associated with each layer. These descriptions are stored by test-hole number, latitude and longitude, and layer number on a disk or magnetic tape. General test-hole information and water-level records are stored



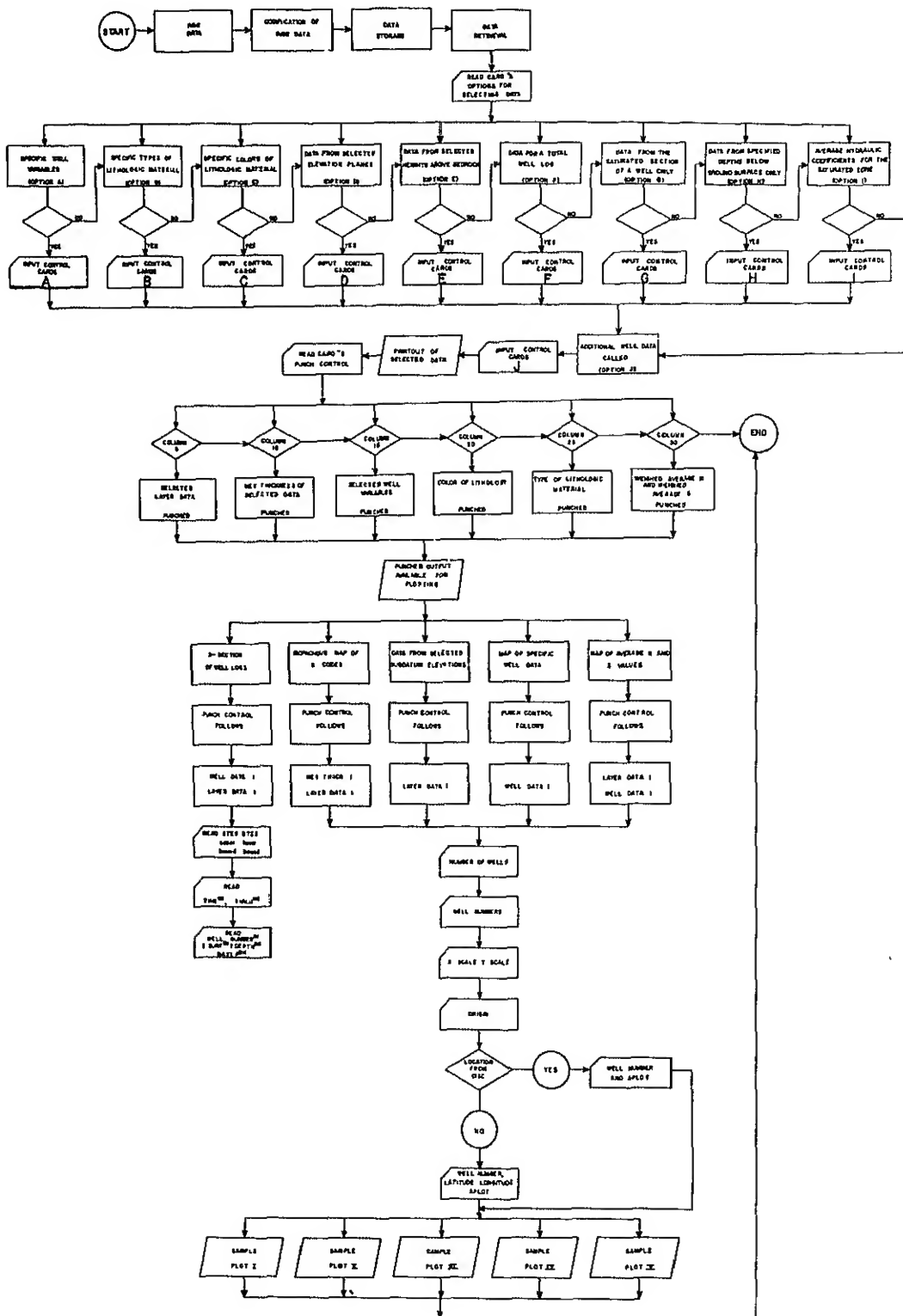


FIGURE 3.—Flow chart for retrieval of hydrogeologic data.



by well number and location on separate disks or magnetic tapes. Specific information related to each of these data is numerically coded and stored by variable number. Combinations of these stored data are used as criteria in the selection of other data or as data that are to be shown graphically.

The hydraulic characteristics of a multi-layered aquifer system can be evaluated by options that allow selective retrieval of data. Ten options for data selection and comparison are specified on control cards. A general flow chart of the retrieval program is shown in figure 3. Figure 4 shows how each specific option is selected. Control-card layouts for retrieval options A through J and a description of card types A through N appear in appendix A. The variable name and columns assigned to each code are shown for each option. A list of variable names with descriptions also appears in appendix A. In addition to the options described, subroutine packages may be introduced to be called by specified control cards.

*Data-storage format.*—The data-storage program reads data from punched cards in the formats shown in appendix B and stores them on magnetic tape. Twenty-one variables are stored for each test hole, including variables that describe the entire well, such as the type of well casing or the elevation of the top of the pipe. These variables are presented in table 1.

Twenty lithologic zones or layers are allowed for each test hole. Currently, no more than 14 distinguishable layers have been stored for any one test hole. There are eight variables describing the lithologic characteristics of each layer, such as layer thickness or the type of material. These variables (table 1) are read from punched cards according to the format shown in appendix B and stored on magnetic tape.

Ground-water levels are stored on magnetic tape for use in conjunction with the test-hole and lithologic-layer data. The format used on punched cards to store the data is shown in appendix B. Storage and retrieval programs for test-hole, layer, and water-level data, along with comments and execution cards, appear in appendix C. The three basic graphical forms produced are test-hole cross sections, lithology-distribution maps, and isopachous maps. A separate retrieval program (not shown in fig-

ure 2) provides data for maps that show the distribution and change in level of the ground-water surface.

*Coding and storage of lithologic data.*—The lithologic type and color are described with unique combinations of numbers (table 2). Only five numbers representing grain size are used in the code to describe the lithologic type because

TABLE 1.—*Data-processing code for tape storage, entire well*

Variable	Term	Code form <sup>1</sup>
1	Well number or test-hole number .....	XXXX
2	Watershed number .....	XXX
3	Location (latitude: degrees, minutes, seconds) .....	XX XX XX
4	Location (longitude: degrees, minutes, seconds) .....	XX XX XX
5	Top of pipe elevation .....	XXXX.XX
6	Ground-surface elevation .....	XXXX.XX
7	Bedrock elevation .....	XXXX.XX
8	Total depth of test-hole log (ft) .....	XXX
9	Distance from logged well to observation well (ft) .....	XXXXXX
10	Total depth of observation well (ft) .....	XXX
11	Drilling method .....	X
	Core .....	1
	Rotary .....	2
	Split spoon .....	3
	Auger .....	4
12	Casing type .....	X
	Metal .....	1
	Plastic .....	2
13	Casing length (ft) .....	XXX
14	Casing diameter (in) .....	XX.XX
15	Screen .....	XXX.XX
	Screen length (ft) .....	XX.XX
	Screen diameter (in) .....	XXX.XX
16	Pump type .....	X
	Submersible .....	1
	Jet .....	2
	Turbine .....	3
	Centrifugal .....	4
17	Pump use .....	X
	Domestic .....	1
	Irrigation .....	2
	Experimental .....	3
18	Pump capacity (gal/min) ..	XXXX
19	Number of stages .....	XX
20	Pump diameter (in) .....	XX.X
21	Number of layers .....	XX

<sup>1</sup> An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable. For example, a 4 put in the space designated by the X after "drilling method" would only select wells drilled by an auger.

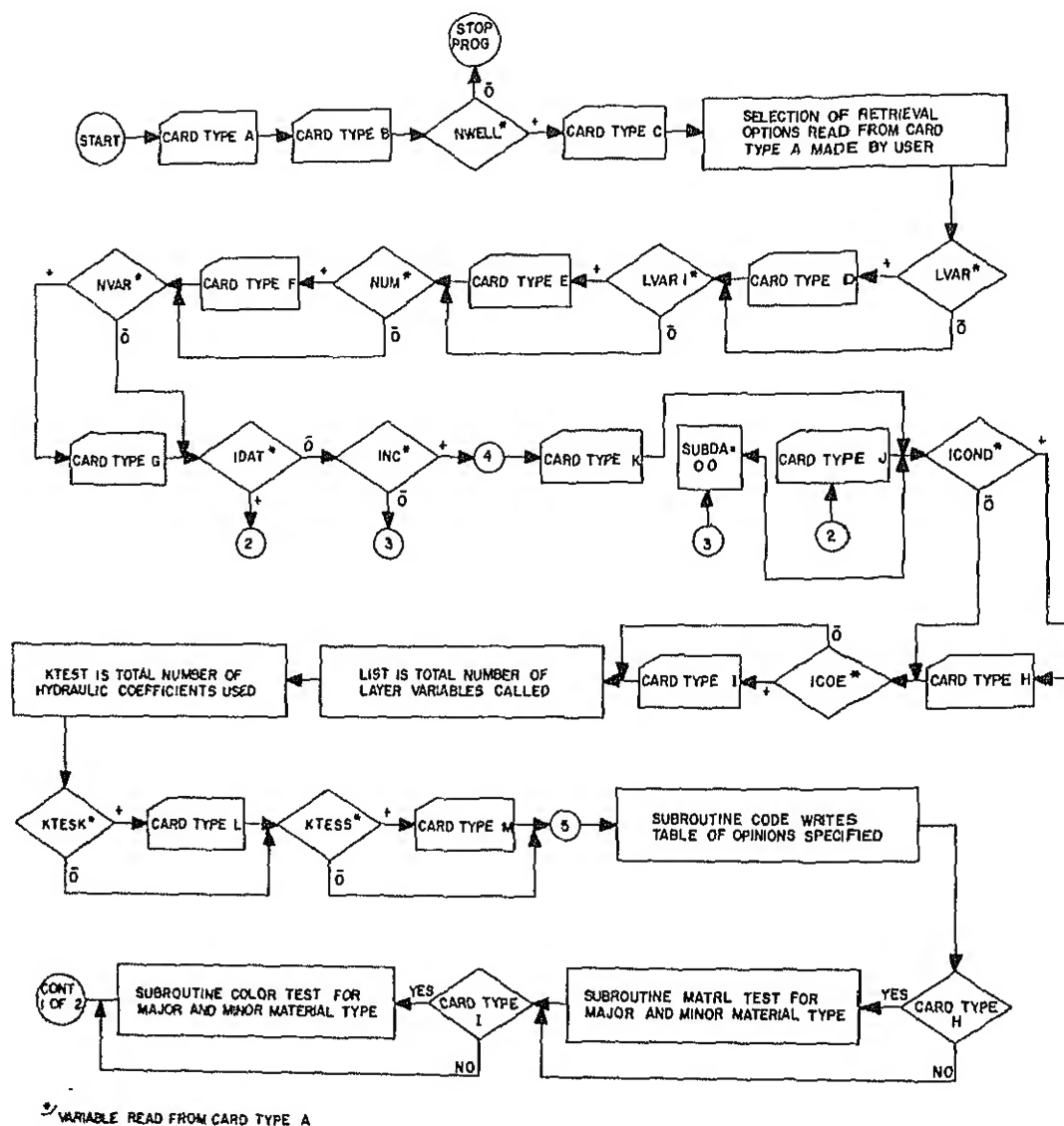
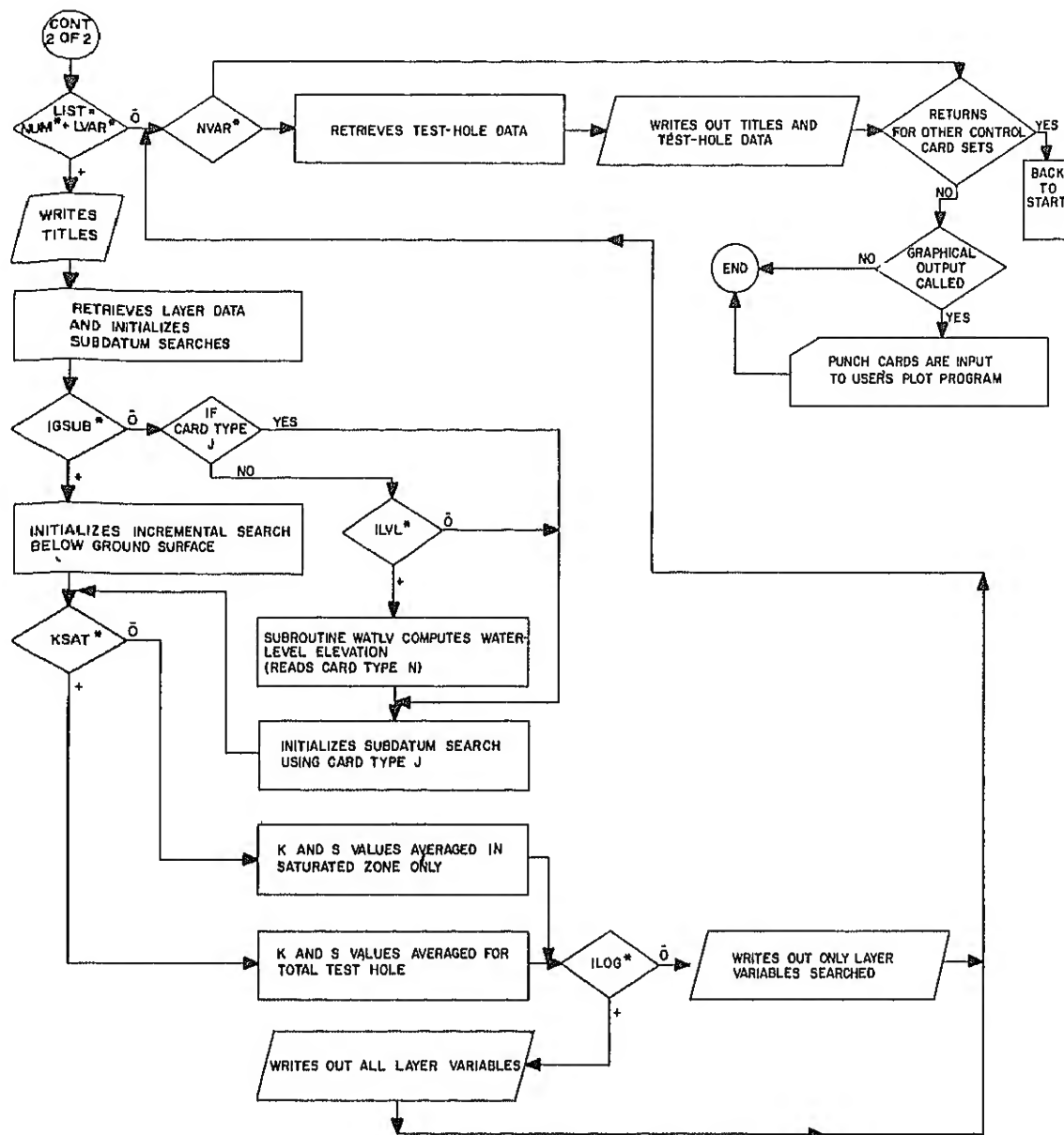


FIGURE 4.—Flow chart for

of computer storage limitations. The codes are stored by lithologic layer in the computer. Two primary or one primary and one secondary constituent describe each lithologic layer. These data are also reduced to a form that can show the hydraulic properties (coefficients) of the aquifer.

The lithologic type and color are based on log descriptions made in the field. These logs need to be interpreted accurately before the data can be standardized and stored as layer data. For analytical interpretation of test-hole

logs, samples are taken from holes cored adjacent to formerly drilled test sites. Grain size of each core sample is visually described and analyzed for comparison with descriptions based on drill cuttings. The median grain size is equivalent to the grain size having the highest percentage of occurrence in the drill-cutting sample and is termed "primary constituent." A grain size representing a smaller percentage of the sample is labeled "secondary constituent." With these comparisons and terms, quantitative relationships can be transposed into



retrieval control cards, A-N.

terms for coding the visual description of drill cuttings.

Hydraulic properties of the aquifer are determined by using a relationship between grain size and the hydraulic coefficients (fig. 5). The hydraulic coefficients (the coefficients of permeability and storage) are based on field-pump tests of selected alluvial material, laboratory tests of the core samples, and grain size-specific yield relationships (2). The hydraulic properties are coded by dividing the primary and secondary grain sizes into four

identifiable ranges (table 3). Undifferentiated sand is included in a fifth range.

A computer program (appendix D) is used to assign a range number (1-5) to the layers of each well on the basis of the coded lithologic description shown in table 4. Hydraulic-coefficient values representing these ranges can be arbitrarily selected from a graphical relationship similar to the one shown in figure 5. The grouping technique makes them applicable to all drill-log data, with only the values represented by each code being subject to change

TABLE 2.—Data-processing code for tape storage, stratigraphic layers

Variable	Term	Code form <sup>1</sup>	Variable	Term	Code form <sup>1</sup>
1	Layer number . . . . .	XX	3	Type of material—Continued: <sup>2</sup>	
2	Layer thickness . . . . .	XX		Log-description adjective . . . . .	X
3	Type of material: <sup>2</sup> column 1, number of primary constituents (zero if unknown); column 2, code of primary constituent; column 3, code of adjective for primary constituent (zero if primary constituent has no adjective); column 4, numeral 1 if second primary constituent or secondary constituent has no adjective (zero if no secondary constituent), or code of secondary constituent if it has an adjective, or code of second primary constituent with adjective; column 5, code of second primary constituent with no adjective or secondary constituent with no adjective (zero if no second primary constituent or secondary constituent exists), or code of adjective for secondary constituent, or code of adjective for second primary constituent.	XXXXX		Very fine . . . . .	2
	Constituents . . . . .	X		Fine . . . . .	3
	Clay . . . . .	0		Medium . . . . .	4
	Silt . . . . .	1		Coarse . . . . .	5
	Sand . . . . .	2		Lime . . . . .	6
	Gravel . . . . .	3		Dolomite . . . . .	7
	Sandstone . . . . .	4		Halite . . . . .	8
	Carbonate . . . . .	5		Fossiliferous . . . . .	9
	Shale . . . . .	6	4	Color of material: major color is the left digit, minor color the right digit (a zero in either place indicates no color). <sup>3</sup>	XX
	Evaporite . . . . .	7	5	Analytical method . . . . .	X
	Undifferentiated alluvium . . . . .	8		Visual accumulation tube . . . . .	1
	Undifferentiated bedrock . . . . .	9		Sieve . . . . .	2
				Driller inspection (field) . . . . .	3
				Microscopic examination . . . . .	4
				HYDRAULIC COEFFICIENTS <sup>1</sup>	
			6	Transmissibility (T) (gpd/ft) . . . . .	X
				Values from 0 to 8,000 . . . . .	1
				Values from 8,000 to 30,000 . . . . .	2
				Values from 30,000 to 80,000 . . . . .	3
				Values from 80,000 to 150,000 . . . . .	4
			7	Permeability (K) (gpd/ft <sup>2</sup> ) . . . . .	X
				Values from 0 to 80 . . . . .	1
				Values from 80 to 300 . . . . .	2
				Values from 300 to 800 . . . . .	3
				Values from 800 to 1,500 . . . . .	4
			8	Storage coefficient (S) (dimensionless ratio) . . . . .	X
				Values from 0.0000 to 0.0001 . . . . .	1
				Values from 0.0001 to 0.0009 . . . . .	2
				Values from 0.0009 to 0.0020 . . . . .	3
				Values from 0.0020 to 0.0040 . . . . .	4

<sup>1</sup> An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable.

<sup>2</sup> For example, a log description of a primary and a secondary constituent as "medium sand, with some fine sand" results in a code name of "sand, medium, with some sand, fine," or a number code of 12423. Again, a log description of two primary constituents as "medium sand, and fine sand" results in a code name of "sand, medium, and sand, fine," or a number code of 22423.

<sup>3</sup> For example, a sample with a major color of red but no minor color would be coded 20, one with no major color but a minor color of red, 02; a sample with a major color of red and a minor color of brown would be coded 25, one with a major color of brown and a minor color of red, 52. A code of 00 indicates no color at all was recorded.

<sup>1</sup> Code numbers 1–4 represent a range of values for T, K, and S.

based upon the geological materials being investigated.

*Retrieval of lithologic data.*—Data can be retrieved in many forms, but the most useful are cross sections and maps that define aquifer boundaries and the horizontal or vertical distribution of the hydraulic properties in the aquifer. The schematic diagram of the retrieval system (fig. 6) shows the assignment and use of the ranges and corresponding estimated values of the hydraulic coefficients for presentation in different graphical forms. Retrieval and testing of test-hole, layer, and water-level data are essential to provide information necessary for selection and plotting of specified ranges of the hydraulic coefficients (fig. 2). Retrieval of test-hole data provides information necessary for selection and plotting of the ranges at a specified depth or subdatum elevation. Water-level data are used to select ranges characteristic of each layer within the saturated zone. Testing on the range number of the hydraulic coefficient permits the selection of specified ranges of the hydraulic coefficients.

TABLE 3.—*Lithologic type and associated range of the hydraulic coefficients*

Range <sup>1</sup>	Lithologic description of log <sup>2</sup>
1	Silt; silt with some very fine sand; very fine sand with some silt; silt and very fine sand.
2	Very fine sand; very fine sand with some fine sand; fine sand with some very fine sand; very fine sand and fine sand.
3	Fine sand; fine sand with some medium sand; medium sand with some fine sand; fine and medium sand.
4	Medium sand; coarse sand and gravel; medium sand with some coarse sand and gravel; coarse sand and gravel with some medium sand; medium and coarse sand.
5	Undifferentiated material in ranges 2, 3, and 4.

<sup>1</sup> Zero is used when a range cannot be assigned to a layer.

<sup>2</sup> Combination of primary and secondary constituents that are classified as indicated.

<sup>3</sup> Silt and clay are undifferentiated.

TABLE 4.—*List of codes representing four groups of relative permeability*

Clay and silt (1)		Sand					
		Very fine to fine (2)		Fine to medium (3)		Medium to coarse (4)	
10000	20011	12211	22211	12324	22324	12500	22524
10011	20012	12311	22311	12423	22423	12524	22425
10012	20013	12011	21122	12300		12425	23125
10013		11122	21123	12400		13000	23124
	20017	11123	22223	12413		13012	22513
10017	20019	12200	22322			13125	
10019	23010	12300				13124	
10125	21010	12223				12513	
10124	21012	12322					
10123	21013						
10122							
12210							
12310							
12410							
12510							
12010							
13010							
11000							
11010							
11012							
11013							
11017							
11019							
13011							
16000							

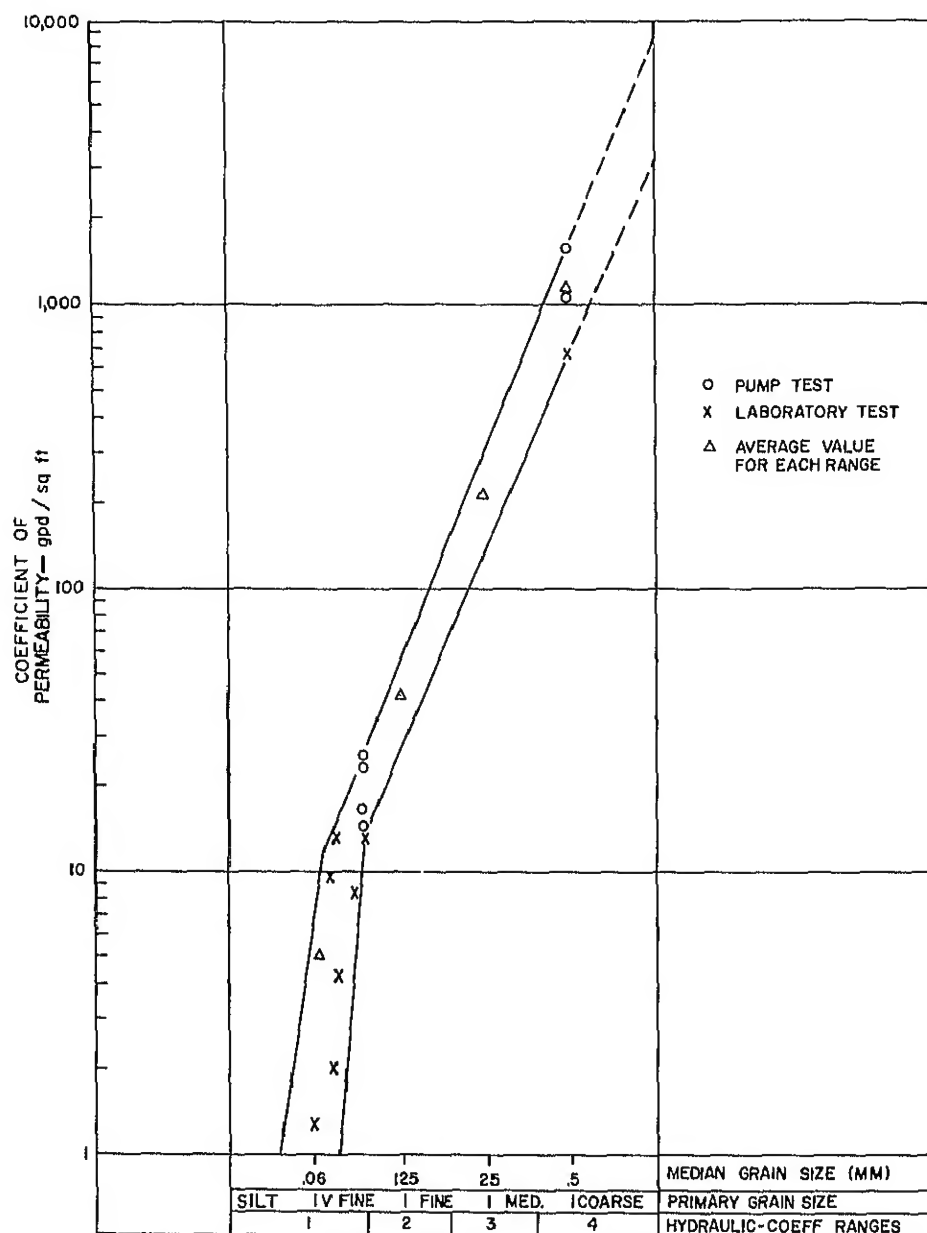


FIGURE 5.—Relationship between hydraulic-coefficient ranges, median grain size, and the coefficient of permeability.

One important aspect of the retrieval system is the use of water-level records for selecting data in the saturated zone. A subroutine which computes a weighted average of all measurements within a selected time period is used to determine the average elevation of the ground-water surface in each well.

## GRAPHICAL PRESENTATIONS

Examples are given of five basic types of graphical presentations of data retrieved. One

cross-section display and four possible map-view displays are shown. A flow chart of the steps followed in preparing graphical displays and the list of variable names, with descriptions, used to plot selected data are shown in appendix E.

*Cross sections of drill-hole logs.*—Drill-hole data are punched on cards and may be used as input data for plotter programs. The control-card setup required to retrieve data for the plotting of cross sections is shown in figure 7.

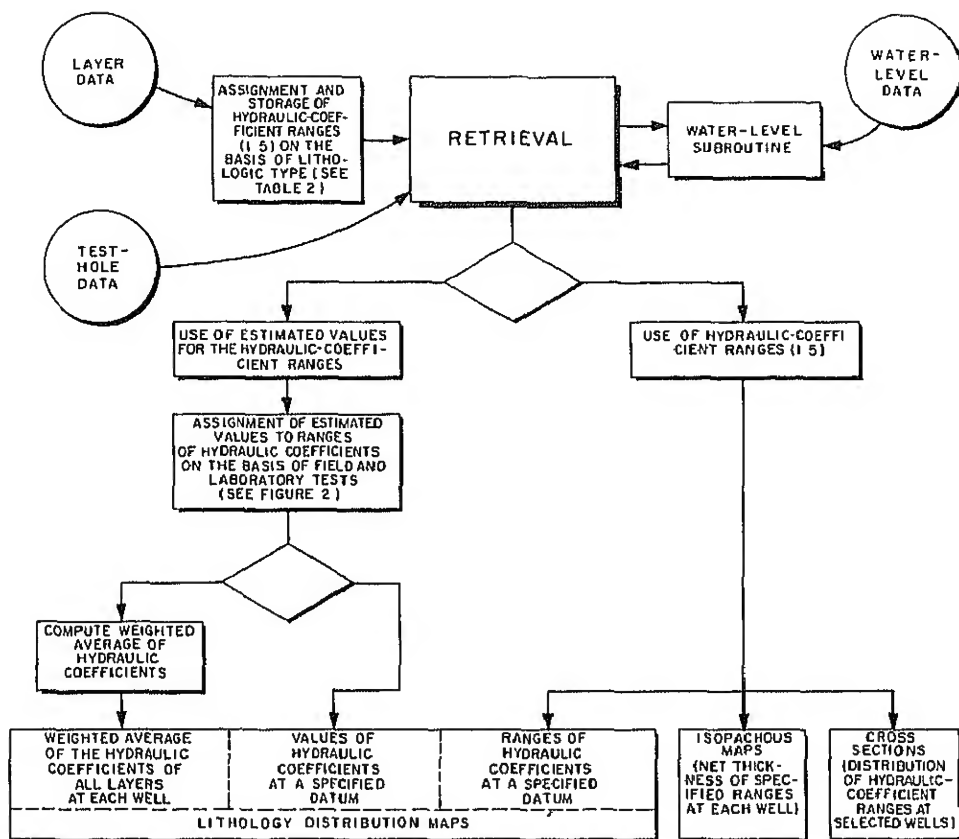


FIGURE 6.—Data-retrieval system using hydraulic coefficients.

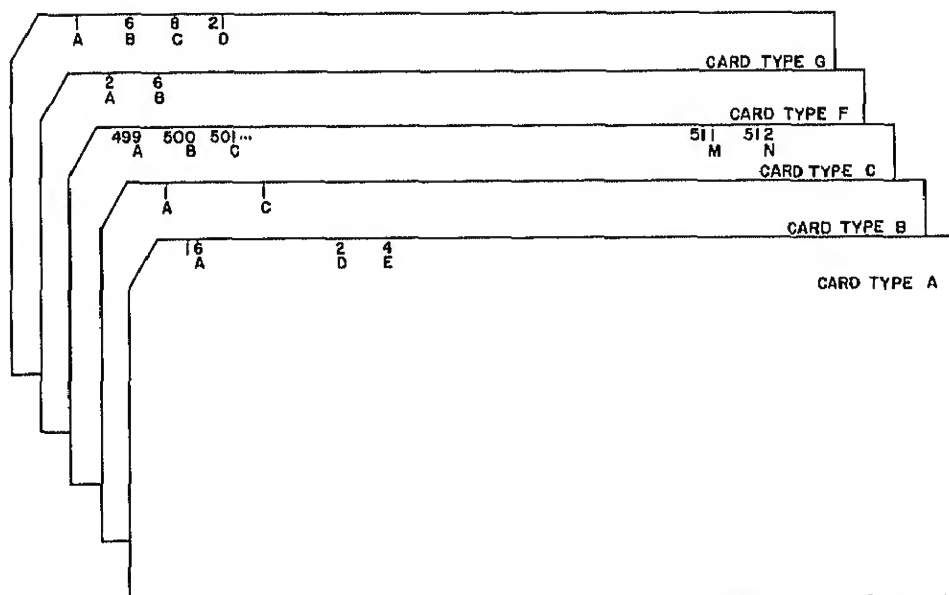
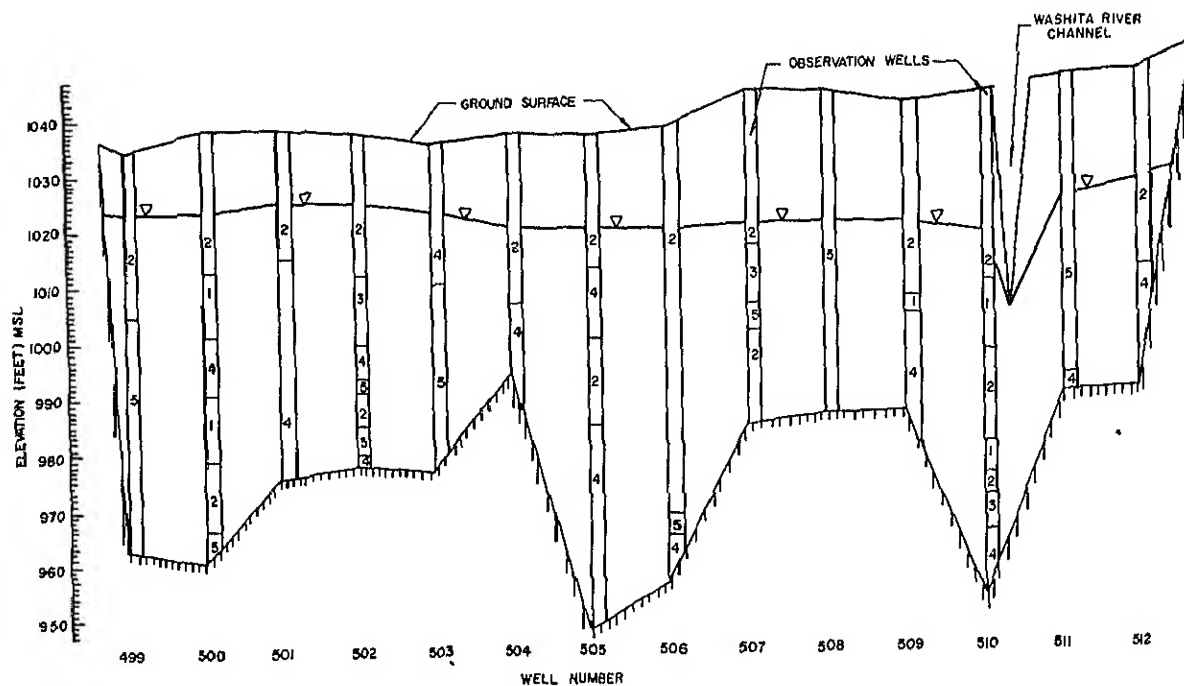
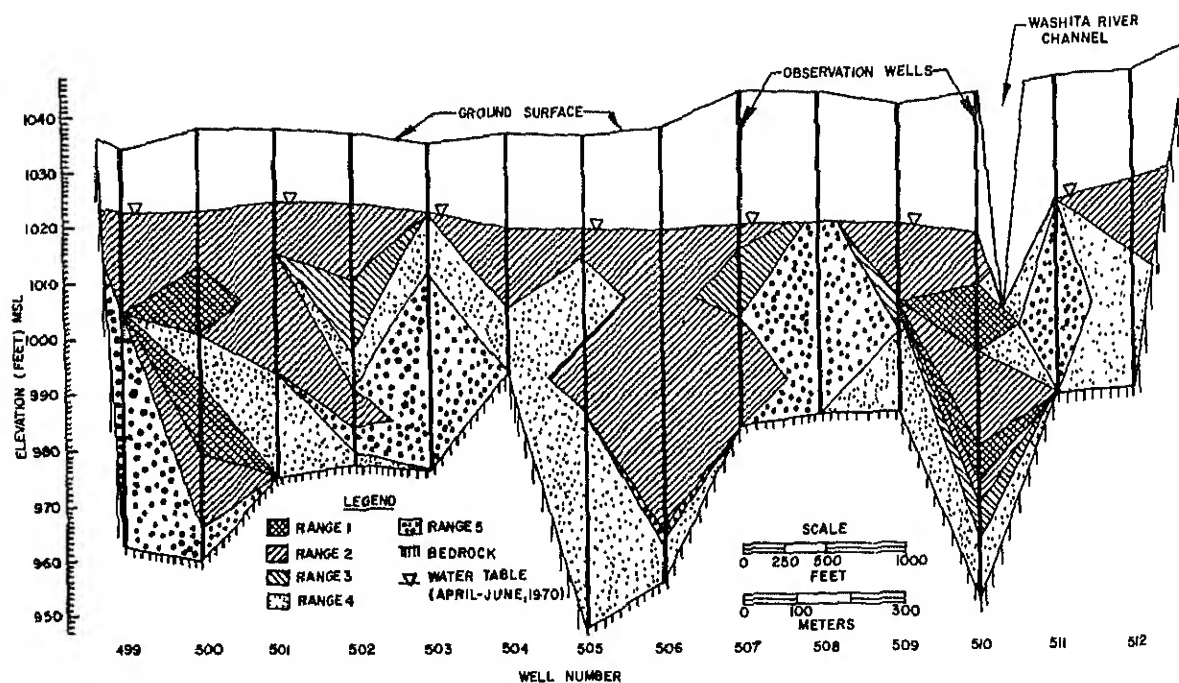


FIGURE 7.—Control cards for retrieval of data for plotting cross sections.



COMPUTER PLOT OF PERMEABILITY RANGES



INTERPRETED CROSS SECTION FROM COMPUTER PLOT  
FIGURE 8.—Cross section near Alex, Okla.



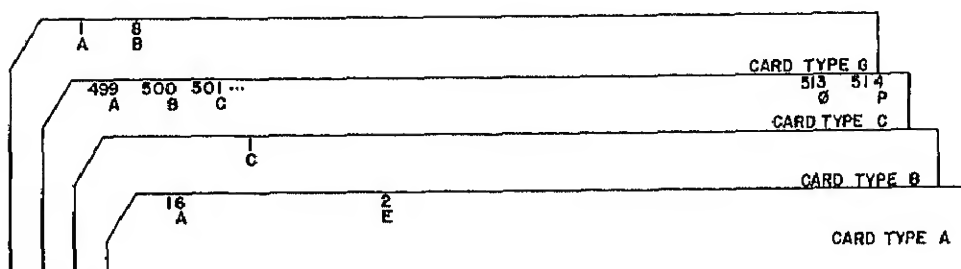


FIGURE 9.—Control cards for retrieval of data for mapping distributions of selected hole data.

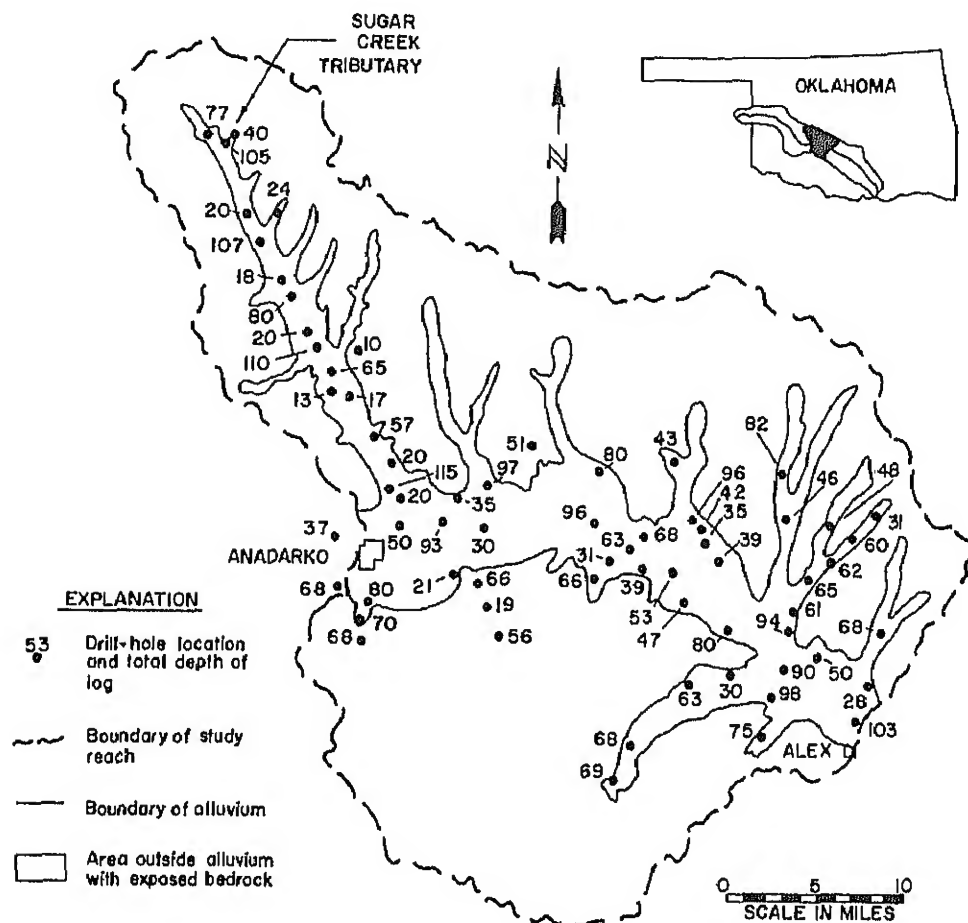


FIGURE 10 —Distribution of total depth of test holes.

For plotting options available, a description of each retrieval control card used is found in appendix A.

A plotted cross section of drill holes near Alex, Okla., is shown in figure 8. Appendix F shows the data cards used to plot cross sections. The variable name, type of plot, and column in which each variable is coded are shown for each card. These data may then be used on the plotting equipment available to the user.

*Maps of distributed drill-hole data.*—The total depths of the test holes were plotted as a distributive map. The control cards for the plotter program are listed in figure 9, and a map showing the distribution of the total depth of each test-hole log appears in figure 10. The map shows the depth to which lithologic data are available, since some test holes were not drilled to bedrock. Appendix F contains the data cards used to plot selected data maps, with

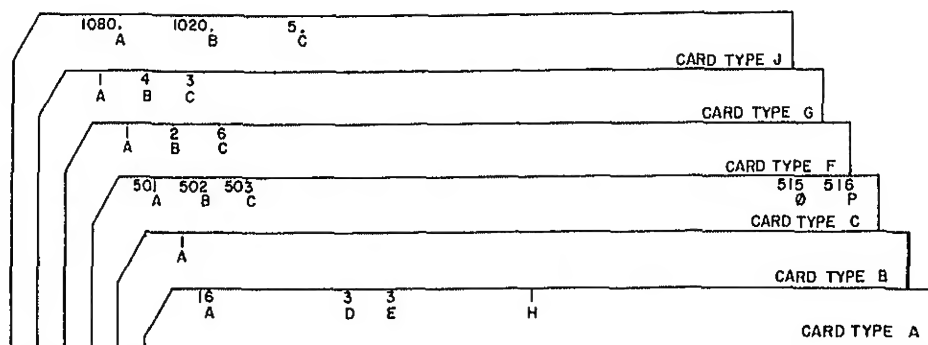


FIGURE 11.—Control cards for retrieval of hydraulic-coefficient ranges at a specified subdatum.

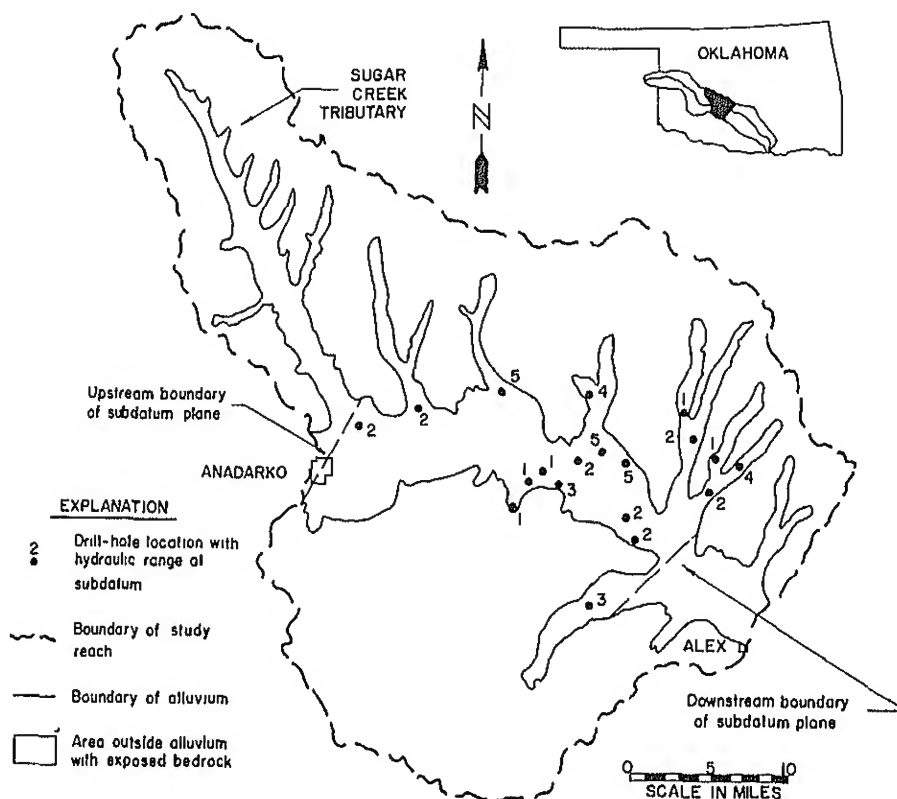


FIGURE 12.—Map of hydraulic ranges for a specified subdatum elevation.

the type of plot, variable name, and column containing the variable code indicated. Any of the 21 test-hole variables may be retrieved for plotting as a distributive map. Appendix E gives a list of variable names and their descriptions for all example plots.

*Maps of data from specified elevations.*—Because hydrogeologic data concern information that must be gathered at some depth below the surface of the ground, a convenient method of looking at various levels, or subdatum eleva-

tions, was developed by the authors. Digital computer techniques are used to develop a planar surface of lithologic data for a specified elevation above mean sea level. Figure 11 shows the control cards for the subdatum searching. A map of the test holes that have lithology with hydraulic coefficients ranging from 1 to 5 at the specified subdatum is presented in figure 12. Appendix F contains the data cards needed to plot the map shown in figure 12.

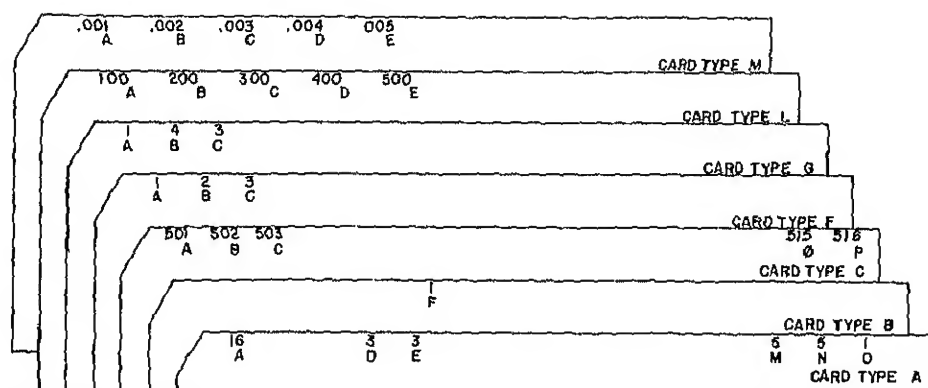


FIGURE 13.—Control cards for retrieval of weighted averages of the hydraulic coefficients of all layers in each hole.



FIGURE 14.—Map of average permeability coefficients.

*Maps of average coefficients of permeability and storage.*—When the ground-water flow through a specified cross section or the amount of ground water stored in a region of a watershed is needed, it is sometimes desirable to average the coefficients of permeability and storage of the layers that the test hole penetrates. Figure 13 shows the control cards for averaging these hydraulic parameters.

Those averaged values of  $K$  (permeability), when displayed in map view (as shown in fig-

ure 14), provide a distribution of test holes that are potentially high or low in ground-water yield. A distributive map of  $S$  (storage coefficient) may be produced using the system. It is possible to determine suitable well field locations and possible artificial recharge areas using areal maps (fig. 1) developed from the distributed test-hole data.

The retrieved data cards used to plot the map shown in figure 14 are presented in appendix F.

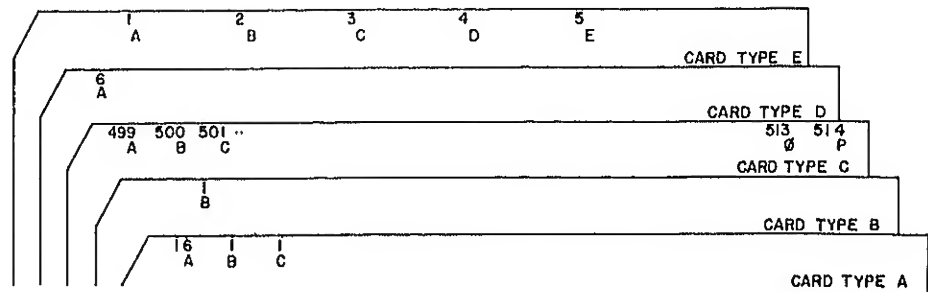


FIGURE 15.—Control cards for retrieval of an isopachous map of lithology having permeability ranges 1-5.

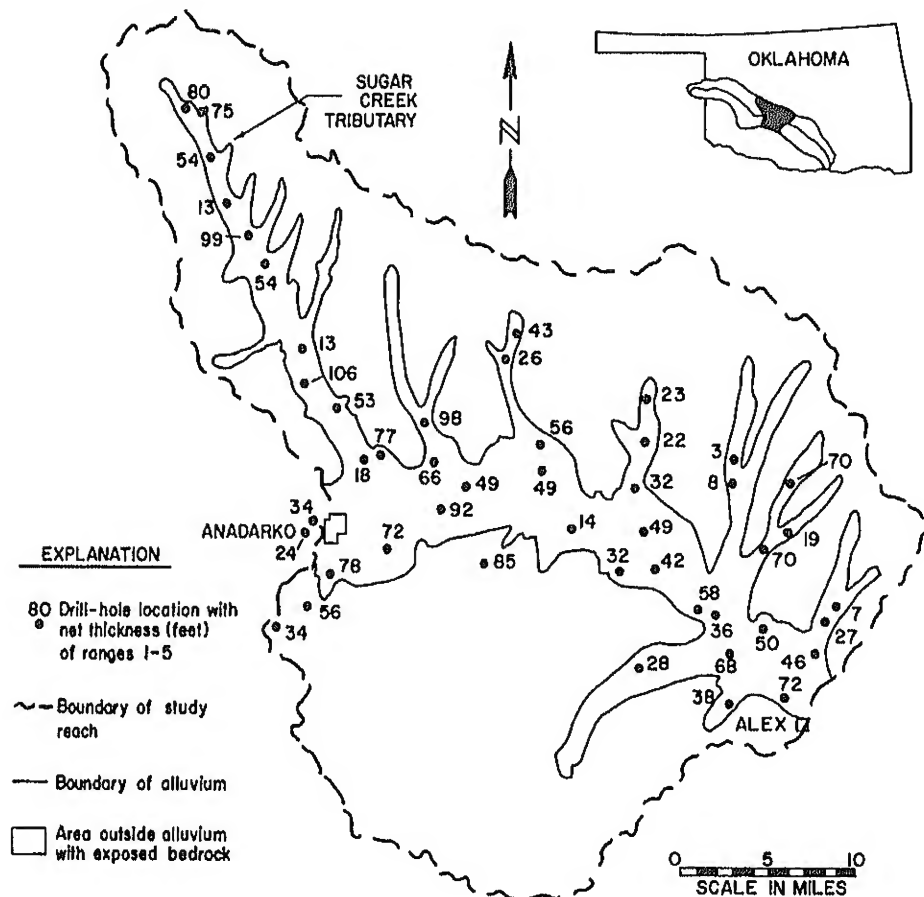


FIGURE 16.—Isopachous map of hydraulic properties, ranges 1-5.

*Isopachous maps of specific hydraulic properties.*—An isopachous map of all the lithologies within an alluvial system having the same hydraulic properties was also plotted. Such a map is used by planners when well fields are being installed or augmented. The amount of ground water available in an area may be determined from such a map (3).

A control-card setup for retrieving data for an isopachous map of all subsurface materials having a hydraulic code 1-5 is presented in figure 15. The isopachous map plotted is shown in figure 16.

Appendix F shows the retrieved data cards used to plot the map shown in figure 16.

## LITERATURE CITED

- (1) Friedrich, B. R. 1970. Information storage and retrieval system for well hydrograph data user's manual Battelle Northwest Laboratories Publ. BNWL-1705, 48 pp.
- (2) Johnson, A. E. 1967. Specific yield—compilation of specific yields for various materials. U.S. Geol. Surv. Water-Supply Pap. 1662-D, 74 pp.
- (3) Kent, D. C., Naney, J. W., Barnes, B. B. 1973. An approach to hydrogeologic investigations of river alluvium by the use of computerized data processing techniques. Ground Water 11(4): 30-41.
- (4) Levings, G. W. 1971. A ground water reconnaissance study of the upper Sugar Creek watershed, Caddo County, Okla. 107 pp. M.S. thesis, Oklahoma State University, Stillwater, Okla.
- (5) Morgan, Charles O., and McNellis, Jesse M. 1971. Reduction of lithologic-log data to numbers for use in the digital computer. Math. Geol. 3(1): 79-86.
- (6) Naney, James W., and Kent, Douglas C. 1971. Ground-water research in the Washita River basin. In Research on the Washita—1961-1971, pp. 19-24. U.S. Department of Agriculture, Agricultural Research Service, Southern Plains Watershed Research Center, Chickasha, Okla.
- (7) Rayner, F. A., and Sechrist, A. W. 1969. Procedures for codification of ground-water data High Plains Underground Water Conservation District No. 1, 64 pp.

## APPENDIX A.—CONTROL-CARD SETUPS, CARD SPECIFICATIONS, AND LIST OF VARIABLES FOR OPTIONS A-N

### Control-Card Setups

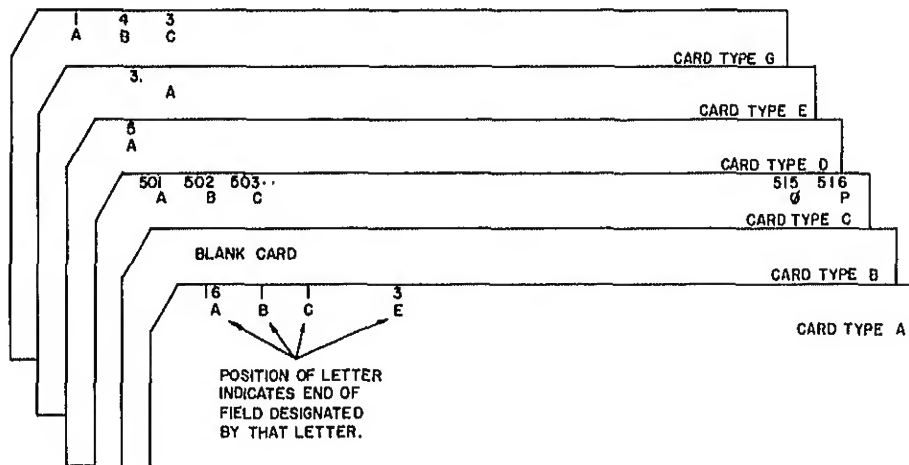


FIGURE A-1.—Retrieval option A: special drill-hole data.

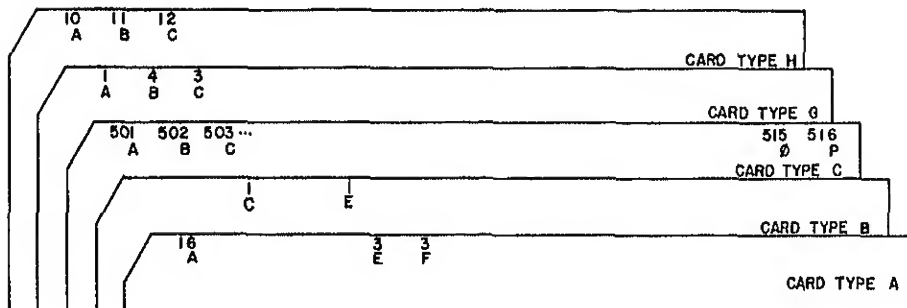


FIGURE A-2.—Retrieval option B: type of material.

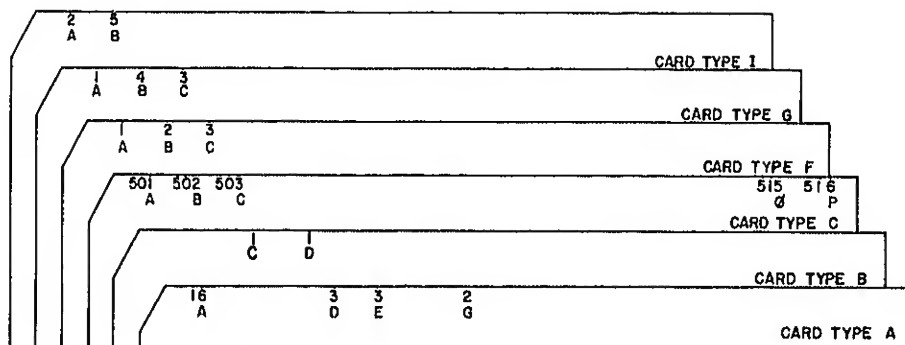


FIGURE A-3.—Retrieval option C: color of material.

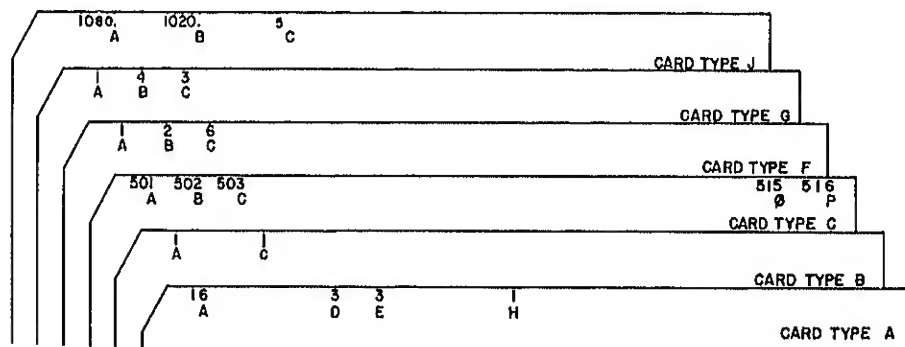


FIGURE A-4.—Retrieval option D: data from specified subdatum planes.

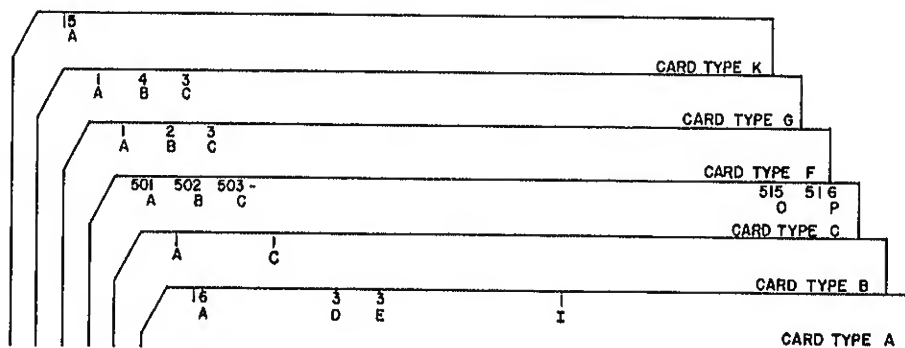


FIGURE A-5.—Retrieval option E: data from selected heights above bedrock.

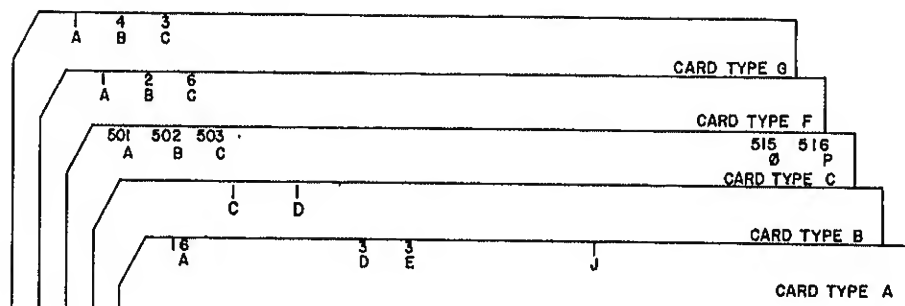


FIGURE A-6.—Retrieval option F: data for logging a test hole.

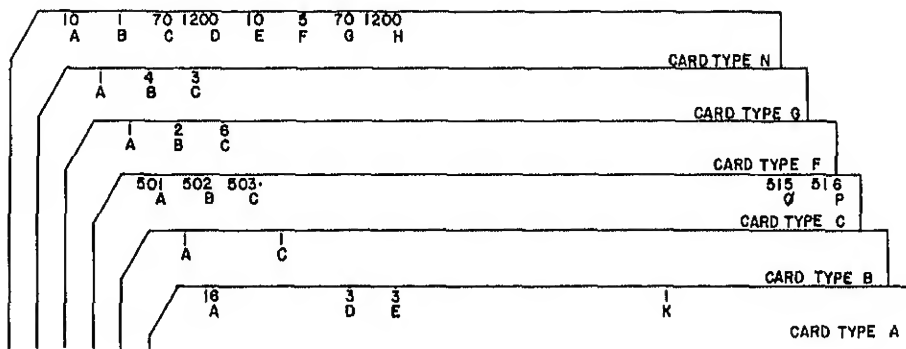


FIGURE A-7.—Retrieval option G: data from saturated zone.

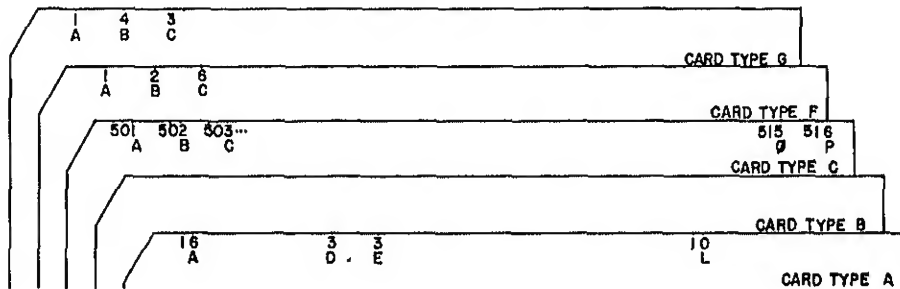


FIGURE A-8.—Retrieval option H: data from specified depths below ground surface.

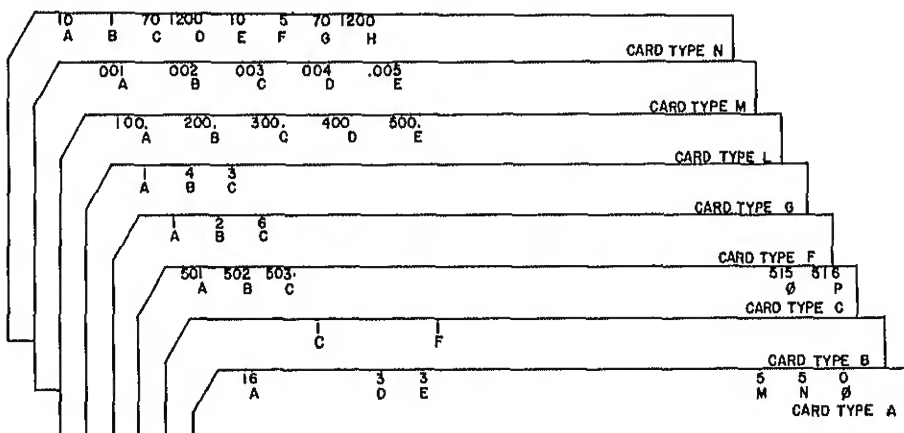


FIGURE A-9.—Retrieval option I: average hydraulic coefficients for the saturated zone.

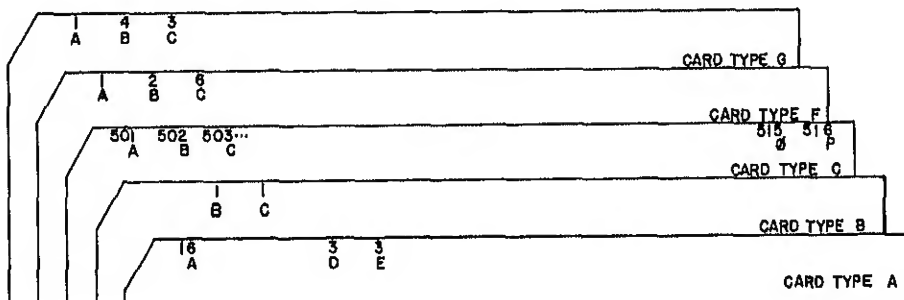


FIGURE A-10.—Retrieval option J: selection of all test-hole and layer data.

## Card Specifications

CARD TYPE A

VARIABLE OPTION	COLUMN	INWELL 1-5	LVAR 6-10	LVARI 11-15	NUM 16-20	NVAR 21-25	ICOND 26-30	ICOL 31-35	IDAT 36-40	INC 41-45	ILOG 46-50	ILVL 51-55	IGSUB 56-60	KTESK 61-65	KTESS 66-70	KSAT 71-75	
A		X	X	X		X											
B		X				X	X										
C		X			X	X		X									
D		X			X	X			X								
E		X			X	X				X							
F		X			X	X					X						
G		X			X	X						X					
H		X			X	X							X				
I		X			X	X								X	X	X	
J		X			X	X											

CARD TYPE B

VARIABLE OPTION	COLUMN	IPUNH(1) 1-5	IPUNH(2) 6-10	IPUNH(3) 11-15	IPUNH(4) 16-20	IPUNH(5) 21-25	IPUNH(6) 26-30	
A								
B				X		X		
C				X	X			
D		X		X				
E		X		X				
F				X	X			
G		X		X				
H				X				
I				X			X	
J				X				

CARD TYPE C

VARIABLE OPTION	COLUMN	IWELL(1) 1-5	IWELL(2) 6-10	IWELL(3) 11-15	IWELL(4) 16-20	IWELL(5) 21-25	IWELL(6) 26-30	IWELL(7) 31-35	IWELL(8) 36-40	IWELL(9) 41-45	IWELL(10) 46-50	IWELL(11) 51-55	IWELL(12) 56-60	IWELL(13) 61-65	IWELL(14) 66-70	IWELL(15) 71-75	IWELL(16) 76-80
A																	
B																	
C		CARD CONTAINS TEST-HOLE NUMBERS TO BE SEARCHED.  MORE THAN ONE TYPE C CARD MAY BE USED FOR ANY  OPTION. MAXIMUM OF 1,000 TEST HOLES MAY BE  SEARCHED.															
D																	
E																	
F																	
G																	
H																	
I																	
J																	

FIGURE A-11.—Description of card types A, B, and C.



CARD TYPE D									
VARIABLE OPTION	COLUMN	IVAR(1) 1-5	IVAR(2) 6-10	IVAR(3) 11-15	IVAR(4) 16-20	IVAR(5) 21-25	IVAR(6) 26-30	IVAR(7) 31-35	IVAR(8) 36-40
A		X							
B									
C		AS MANY AS 8 LAYER VARIABLES MAY BE TESTED IN OPTION A							
D									
E									
F									
G									
H									
I									
J									

CARD TYPE E									
VARIABLE OPTION	COLUMN	TVALU(1) 1-12	TVALU(2) 13-24	TVALU(3) 25-36	TVALU(4) 37-48	TVALU(5) 49-60	TVALU(6) 61-72		
A		X							
B									
C		AS MANY AS 8 LAYER-VARIABLE VALUES MAY BE TESTED IN OPTION A. ADDITIONAL CARD TYPE E IS NEEDED IF MORE THAN 6 VALUES ARE USED.							
D									
E									
F									
G									
H									
I									
J									

CARD TYPE F									
VARIABLE OPTION	COLUMN	LADVR(1) 1-5	LADVR(2) 6-10	LADVR(3) 11-15	LADVR(4) 16-20	LADVR(5) 21-25	LADVR(6) 26-30	LADVR(7) 31-35	LADVR(8) 36-40
A									
B									
C		X	X	X		AS MANY AS 8 ADDITIONAL LAYER VARIABLES MAY BE SELECTED.			
D		X	X	X					
E		X	X	X					
F		X	X	X					
G		X	X	X					
H		X	X	X					
I		X	X	X					
J		X	X	X					

FIGURE A-12.—Description of card types D, E, and F.

CARD TYPE G																								
VARIABLE OPTION	COLUMN	ISTOR(1) 1-5	ISTOR(2) 6-10	ISTOR(3) 11-15	ISTOR(4) 16-20	ISTOR(5) 21-25	ISTOR(6) 26-30	ISTOR(7) 31-35	ISTOR(8) 36-40	ISTOR(9) 41-45	ISTOR(10) 46-50	ISTOR(11) 51-55	ISTOR(12) 56-60	ISTOR(13) 61-65	ISTOR(14) 66-70	ISTOR(15) 71-75	ISTOR(16) 76-80							
A		X	X	X																				
B		X	X	X																				
C		X	X	X		AS MANY AS 21 TEXT-HOLE-RELATED VARIABLES MAY BE SELECTED IN ANY OPTION. ADDITIONAL CARD TYPE G IS NEEDED FOR MORE THAN 16 VARIABLES.																		
D		X	X	X																				
E		X	X	X																				
F		X	X	X																				
G		X	X	X																				
H		X	X	X																				
I		X	X	X																				
J		X	X	X																				

CARD TYPE H											
VARIABLE OPTION	COLUMN	MAJTS(1) 1-5	MAJTS(2) 6-10	MAJTS(3) 11-15	MAJTS(4) 16-20	MAJTS(5) 21-25	MAJTS(6) 26-30	MAJTS(7) 31-35	MAJTS(8) 36-40	MAJTS(9) 41-45	MAJTS(10) 46-50
A											
B		X	X	X							
C						AS MANY AS 10 TYPES OF MATERIAL MAY BE SELECTED.					
D											
E											
F											
G											
H											
I											
J											

CARD TYPE I												
VARIABLE OPTION	COLUMN	MACOL (1) 1-5	MACOL (2) 6-10	MACOL (3) 11-15	MACOL (4) 16-20	MACOL (5) 21-25	MACOL (6) 26-30	MACOL (7) 31-35	MACOL (8) 36-40	MACOL (9) 41-45	MACOL (10) 46-50	
A												
B												
C		X	X			AS MANY AS 10 LITHOLOGY COLORS MAY						
D						BE SELECTED						
E												
F												
G												
H												
I												
J												

FIGURE A-13.—Description of card types G, H, and I.

CARD TYPE J

VARIABLE OPTION	COLUMN	SUBDIA 1-10	SUBTS 11-20	SUBIN 21-30	
A					
B					
C					
D		X	X	X	
E					
F					
G					
H					
I					
J					

CARD TYPE K

VARIABLE OPTION	COLUMN	AINC(1) 1-5	AINC(2) 6-10	AINC(3) 11-15	AINC(4) 16-20	AINC(5) 21-25	AINC(6) 26-30	AINC(7) 31-35	AINC(8) 36-40	AINC(9) 41-45	AINC(10) 46-50	AINC(11) 51-55	AINC(12) 56-60	AINC(13) 61-65	AINC(14) 66-70	AINC(15) 71-75	AINC(16) 76-80
A																	
B																	
C				AS MANY AS 16 INCREMENTS ABOVE BEDROCK MAY BE USED IN OPTION E.													
D																	
E	X																
F																	
G																	
H																	
I																	
J																	

CARD TYPE L

VARIABLE OPTION	COLUMN	AKVAL(1) 1-8	AKVAL(2) 9-16	AKVAL(3) 17-24	AKVAL(4) 25-32	AKVAL(5) 33-40	AKVAL(6) 41-48	AKVAL(7) 49-56	AKVAL(8) 57-64	AKVAL(9) 65-72	AKVAL(10) 73-80		
A													
B													
C				AS MANY AS 10 DISCRETE VALUES OF PERMEABILITY MAY BE SELECTED									
D													
E													
F													
G													
H													
I	X	X	X	X	X								
J													

FIGURE A-14.—Description of card types J, K, and L.

CARD TYPE M											
VARIABLE OPTION	COLUMN	SVAL (1) 1-8	SVAL (2) 9-16	SVAL (3) 17-24	SVAL (4) 25-32	SVAL (5) 33-40	SVAL (6) 41-48	SVAL (7) 49-56	SVAL (8) 57-64	SVAL (9) 65-72	SVAL (10) 73-80
A											
B											
C			AS MANY AS 10 STORAGE-COEFFICIENT VALUES MAY BE SELECTED.								
D											
E											
F											
G											
H											
I		X	X	X	X	X					
J											

CARD TYPE N									
VARIABLE OPTION	COLUMN	IMO 1-5	IDY 6-10	IYR 11-15	ITIM 16-20	JMO 21-25	JDY 26-30	JYR 31-35	JTIM 36-40
A									
B		BEGIN SELECTED TIME PERIOD				END SELECTED TIME PERIOD			
C									
D									
E									
F									
G		X	X	X	X	X	X	X	X
H									
I		X	X	X	X	X	X	X	X
J									

FIGURE A-15.—Description of card types M and N.

## List of Variables

<i>Variable name</i>	<i>Option</i>	<i>Format</i>	<i>Description of variable</i>
Card Type A			
NWELL	A-J	I5	Number of test holes to be searched for data retrieval.
LVAR	A	I5	Number of lithologic-layer variables to be retrieved.
NUM	A	I5	Number of selected values of lithologic-layer variables to be retrieved.
LVAR1	C-J	I5	Number of additional lithologic-layer data to be retrieved.
NVAR	A-J	I5	Number of descriptive well data to be retrieved.
ICOND	B	I5	Number of lithologic materials to be retrieved.
ICOL	C	I5	Number of lithologic colors to be retrieved.
IDAT	D	I5	If a 1 is punched in column 40, data are retrieved from subdatum planes (see card type J). If column 40 is blank, this option is bypassed.

<i>Variable name</i>	<i>Option</i>	<i>Format</i>	<i>Description of variable</i>
Card Type A—Continued			
INC	E	I5	An integer punched in columns 41–45 is the number of increments to be searched above bedrock (see card type K). If columns 41–45 are blank, this option is bypassed.
ILOG	F	I5	A 1 in column 50 indicates a total test-hole-log retrieval. If column 50 is blank, only the selected layer variable is retrieved.
ILVL	G	I5	A 1 in column 55 calls water level for defining saturated zone (see card type N). If column 55 is blank, this option is bypassed.
IGSUB	H	I5	An integer in columns 56–60 indicates the number of feet below ground surface to be searched by increments. If columns 56–60 are blank, this option is bypassed.
KTESK	I	I5	An integer in columns 61–65 indicates the number of permeability values assigned (see card type L). If columns 61–65 are blank, this option is bypassed.
KTESS	I	I5	An integer in columns 66–70 indicates the number of storage-coefficient values assigned (see card type M). If columns 66–70 are blank, this option is bypassed.
KSAT	I	I5	If column 75 is a 1, <i>K</i> and <i>S</i> values are averaged for the total well log. If column 75 is blank, <i>K</i> and <i>S</i> values are averaged only for the saturated zone.

#### Card Type B

IPUNH(1)	D,E,G	I5	A 1 in column 5 causes retrieved layer data to be punched on cards.
IPUNH(2)	J	I5	A 1 in column 10 causes the net thickness of selected lithologic layers to be punched on cards.
IPUNH(3)	B–J	I5	A 1 in column 15 causes test-hole (well) variables to be punched on cards.
IPUNH(4)	C,F	I5	A 1 in column 20 causes lithologic color to be punched on cards.
IPUNH(5)	B	I5	A 1 in column 25 causes lithologic material type to be punched on cards.
IPUNH(6)	I	I5	A 1 in column 30 causes the weighted average of hydraulic coefficients to be punched on cards.

Note: A blank in appropriate columns will bypass punch output for that option.

#### Card Type C

IWELL( <i>n</i> )	A–J	16I5	This array is used to select test-hole data by numbers. As many as 1,000 drill-hole numbers may be retrieved from this array selectively.
-------------------	-----	------	---

Note: *n* indicates array size.

#### Card Type D

IVAR( <i>n</i> )	A	8I5	Data are retrieved from this array for as many as 8 lithologic-layer variables. These variables describe hydraulic and geologic characteristics for discrete layers.
------------------	---	-----	--

<i>Variable name</i>	<i>Option</i>	<i>Format</i>	<i>Description of variable</i>
Card Type E			
TVALU( <i>n</i> )	A	6F12.4	Data are retrieved from this array for as many as 8 test values (6 per card). One or more values may be tested for each variable indicated on card type D. Additional card type E is needed for more than 6 values.
Card Type F			
IADVR( <i>n</i> )	C-J	8I5	Data are retrieved from this array for as many as 8 layer-variable values in addition to the ones tested for using card types D and E.
Card Type G			
ISTOR( <i>n</i> )	A-J	16I5	Data are retrieved from this array for as many as 21 drill-hole variables. An additional card, type G, is needed for more than 16 test-hole variables.
Card Type H			
MAJTS( <i>n</i> )	B	10I5	Data are retrieved from this array for as many as 10 discrete types of material based upon size-distribution analyses.
Card Type I			
MACOL( <i>n</i> )	C	10I5	Data are retrieved from this array for as many as 10 discrete colors of material.
Card Type J			
SUBDA	D	F10.0	Maximum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBTS	D	F10.0	Minimum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBIN	D	F10.0	The distance in feet to be stepped down for subsequent subdatum planes from SUBDA to SUBTS.
Card Type K			
AINC( <i>n</i> )	E	16I5	Data are retrieved from this array for as many as 16 increments (feet above bed-rock) for which data are retrieved.
Card Type L			
AKVAL( <i>n</i> )	I	10F8.0	Data are retrieved from this array for as many as 10 discrete permeability values.
Card Type M			
SVAL( <i>n</i> )	I	10F8.0	Data are retrieved from this array for as many as 10 discrete storage-coefficient values.

<i>Variable name</i>	<i>Option</i>	<i>Format</i>	<i>Description of variable</i>
Card Type N			
IMO	G,I	I5	Month of beginning of time period for which ground-water levels are averaged when data are retrieved from the saturated zone.
IDY	G,I	I5	Day of beginning of time period.
IYR	G,I	I5	Year of beginning of time period.
ITIM	G,I	I5	Time (military) of beginning of time period.
JMO	G,I	I5	Month of ending of time period.
JDY	G,I	I5	Day of ending of time period.
JYR	G,I	I5	Year of ending of time period.
JTIM	G,I	I5.	Time (military) of ending of time period.

## APPENDIX B.—FORMATS USED FOR DATA STORAGE

### INPUT-CARD FORMAT USED TO STORE DRILL-HOLE DATA

I 2	I 5	I 5	I 5	I 5	F 11.3	F 11.3	F 11.3	F 11.3	
VARIABLE NO. (1-21)	DRILL-HOLE NO	DRILL-HOLE NO	DRILL-HOLE NO	DRILL-HOLE NO.	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	COLUMN 67-80 BLANK

### INPUT-CARD FORMAT USED TO STORE LAYER DATA

I 4	F 4.0	F 4.0	X, F 5.0	F 3.0	F 3.0	F 7.0	F 7.0	F 10.0	I 4	
DRILL-HOLE NUMBER (STORED WITH DRILL-HOLE DATA)	(1) LAYER NUMBER	(2) LAYER THICKNESS	(3) TYPE OF MATERIAL	(4) COLOR OF MATERIAL	(5) METHOD OF ANALYSIS	(6) TRANSMISSIBILITY (T)	(7) PERMEABILITY (K)	(8) STORAGE COEFFICIENT (S)	NUMBER OF LAYERS (STORED WITH DRILL-HOLE DATA)	COLUMNS 53-80 BLANK

### INPUT-CARD FORMAT USED TO STORE WATER-LEVEL DATA

I 4	I 2	I 7	I 5	F 7.2	I 7	I 5	F 7.2	I 7	I 5	F 7.2	
WELL NO. *	CODE NO. **	DATE MONTH, DAY, YEAR 2 DIGITS EACH	MILITARY TIME	DEPTH TO WATER *** FEET BELOW TOP OF PIPE	DATE	TIME	DEPTH	DATE	TIME	DEPTH	COLUMN 64-80 BLANK

- \* ALL I FORMAT INPUT DATA IS RIGHT JUSTIFIED  
 \*\* CODE 1 = RECORDER-CHART DATA — CODE 2 = TAPE-DOWN DATA  
 \*\*\* NO ZERO PUNCHES NEEDED IN BLANKS ON CARDS

FIGURE B-1.—Input card formats.



# APPENDIX C.—SOURCE LISTING FOR STORAGE AND RETRIEVAL PROGRAMS

CARD

```

1 C                                APPENDIX C
2 C
3 C
4 C      RETRIEVAL PROGRAM FOR HYDROGEOLOGIC DATA
5 C      SUBROUTINES USED NAMED (CODE, KTESX, COLOR, SERCH, MATRL, TAPES, JULDY,
6 C      WATLV)
7 C      DEFINE FILE 1(1000,161,U,ISEC),2(21,1000,U,ISEC1),3(10,320,U,IM)
8 C      DIMENSION V(21),VV(21),VAR(8)
9 C      DIMENSION MAJTS(10),MACOL(10),WATEL(1000),AINC(20),IPUNH(6)
10 C      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
11 C      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
12 C      COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
13 C      HEADERS READ IN FOR LABELING VARIABLES.
14 C      CONTROLS FOR SELECTING WELL VARIABLES.
15 C      FORMAT(1615)
16 C
17 C      NWELL—NUMBER OF WELLS TO BE SEARCHED.
18 C      LVAR —NUMBER OF LAYER VARIABLES TO BE TESTED.
19 C      LVAR1—NUMBER OF LAYER TEST VALUES, TVALU (1), TO BE READ IN.
20 C      VALUES OF (TVALU (1) FORMAT (6F12.4,/2F12.4))
21 C      NUM —NUMBER OF ADDITIONAL LAYER VARIABLES NOT USED FOR SEARCHING.
22 C      NVAR —NUMBER OF WELL VARIABLES
23 C      ICOND—'0'—BYPASS
24 C      '1'—CALLS IN SUBROUTINE FOR TESTING TYPE OF MATERIAL IN THE LAYERS.
25 C      ICOL— '0'—BY-PASS
26 C      '1'—CALLS IN SUBROUTINE FOR TESTING LAYER COLORS.
27 C      IDAT— '0'—BY-PASS
28 C      '1'—READS IN SUBSTRATUM ELEVATION TO BE TESTED. (SUBDA)
29 C      INC - '0'—BY PASS
30 C      'N'—READS IN NUMBER OF INCREMENTS IN FEET ABOVE BEDROCK TO BE
31 C      SEARCHED.
32 C      ILOG— '0'—WRITES OUT LAYER VARIABLE SEARCHED
33 C      '1'—WRITES OUT ALL LAYERS IN A WELL
34 99997 CONTINUE
35 C      ILVL— '0' BY PASS
36 C      '1' WATER LEVEL CALLED FOR SEARCHING IN SATURATED ZONE
37 C      IGSUB—'0' BY PASS
38 C      '1' STEPS DOWN INCREMENTALLY BELOW GROUND SURFACE
39 C      KTESK—'0' BY PASS
40 C      'N' NUMBER OF PERMEABILITY VALUES TO BE USED
41 C      KTESS—'0' BY PASS
42 C      'N' NUMBER OF STORAGE COEFFICIENT VALUES TO BE USED
43 C      KSAT— '0' BY PASS
44 C      '1' K AND S VALUES ARE AVERAGED FOR TOTAL THICKNESS
45 C      PUNCH A '1' IN ILVL AND A '0' IN KSAT TO AVERAGE K AND S VALUES IN THE
46 C      SATURATED ZONE
47 C      FORMAT FOR VARIABLES NWELL THROUGH KSAT IS 1515.
48 99998 CONTINUE
49 C      IPUNH (N) - '0' NO PUNCH '1' PUNCH
50 C      THE FOLLOWING PUNCH COMMANDS ARE IN SIX SEPARATE FIVE COLUMN FIELDS.
51 C      THE NUMBER FOLLOWING EACH COMMAND IS THE FIELD NUMBER.
52 C      LAYER DATA (1)
53 C      NET THICKNESS (2)
54 C      WELL VARIABLES (3)
55 C      COLOR OF LITHOLOGY (4)
56 C      MATERIAL TYPE OF LITHOLOGY (5)
57 C      WGT. AVE. PERM. AND WGT. AVE. STOR. COEFF. (6)
58 C      VALUES OF SUBDA, SUBTS, SUBIN (FORMAT (3F10.0))
59 C      SUBDA—SUBSTRATUM ELEVATION
60 C      SUBTS—MINIMUM ELEVATION TO BE SEARCHED
61 C      SUBIN—INCREMENT IN FEET TO BE SUBTRACTED FROM SUBDATUM
62 C      SUBROUTINE TAPES LOADS TEST HOLE AND LAYER DATA FROM TAPES TO DISC FILE
63 C      FOR SEARCHING.
64 C      CALL TAPES

```

```

65      DO 1000 J=1,2
66  C    READ LAYER VARIABLE NAMES FROM CONTROL CARDS
67      1000 READ(5,106)((HEAD(J,I),I=1,108)
68      106  FORMAT(72A1,/,36A1)
69      IM=1
70  C    WRITES LAYER VARIABLE NAMES ON DISC
71      WRITE(3,IM)HEAD
72      DO 999 J=1,2
73  C    READ TEST HOLE VARIABLE NAMES FROM CONTROL CARDS
74      999 READ(5,107)((HEAD(J,I),I=1,252)
75      107  FORMAT(72A1/72A1/72A1/36A1)
76      IM=3
77  C    WRITES TEST HOLE VARIABLE NAMES ON DISC
78      WRITE(3,IM)HEAD
79      1012 READ(5, 100)NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IL
80      1VL,IGSUB,KTESK,KTESS,KSAT
81  C    TEST ON NUMBER OF TEST HOLES TO BE SEARCHED
82      IF(NWELL)1013,1013,4000
83  C    READ TEST HOLE NUMBERS TO BE SEARCHED (1615) INTO ARRAY
84      4000 READ(5,100)((IPUNH(I),I=1,6)
85      READ(5,100)((IWELL(I),I=1,NWELL)
86      100  FORMAT(16I5)
87  C    TEST ON NUMBER OF LAYER VARIABLES TO BE TESTED
88      4001 IF(LVAR)4003,4003,4002
89  C    READ VARIABLES TO BE TESTED INTO ARRAY
90      4002 READ(5,100)((IVAR(I),I=1,LVAR)
91  C    TEST ON NUMBER OF TEST VALUES TO BE TESTED FOR
92      4003 IF(LVAR1)4005,4005,4004
93  C    READ VALUE OF LAYER VARIABLE TO BE TESTED INTO ARRAY
94      4004 READ(5,101)((TVALU(I),I=1,LVAR1)
95      101  FORMAT (6F12.4,/2F12.4)
96  C    TEST ON NUMBER OF ADDITIONAL LAYER VARIABLES NEEDED(1-7)
97      4005 IF(NUM)4007,4007,4006
98  C    READ ADDITIONAL LAYER VARIABLES INTO ARRAY
99      4006 READ(5,100)((IADVR(I),I=1,NUM)
100  C    TEST ON NUMBER OF ADDITIONAL TEST HOLE VARIABLES (1-21)
101      4007 IF(NVAR)4009,4009,4008
102  C    READ ADDITIONAL TEST HOLE VARIABLES INTO ARRAY
103      4008 READ(5,100)((ISTOR(I),I=1,NVAR)
104  C    TEST IF SUBDATUM ELEVATION IS TO BE SEARCHED
105      4009 IF(IDAT)3021,3021,3023
106  C    TEST IF A HEIGHT ABOVE BEDROCK IS TO BE SEARCHED
107      3021 IF(INC)3022,3022,3024
108      3024 READ(5,1112)((AINC(I),I=1,INC)
109      1112 FORMAT(16F5.1)
110      GO TO 3124
111      3022 SUBDA=0.0
112      GO TO 3124
113  C    READ FROM ONE CARD,(1)ELEV TO BE SEARCHED,(2)ELEV TO STOP ON,(3)
114  C    INCREMENT TO STEP DOWN- FEET
115      3023 READ(5,500)SUBDA,SUBTS,SUBIN
116      500  FORMAT(3F10.0)
117  C    TEST IF MAJOR OR MINOR LITHOLOGIC TYPE WANTED
118      3124 IF(ICOND)5002,5002,5001
119  C    READ CODE OF LITHOLOGY WANTED INTO ARRAY
120      5001 READ(5,100)((MAJTS(I),I=1,ICOND)
121  C    TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED
122      5002 IF(ICOL)5004,5004,5003
123      5003 READ(5,100)((MACOL(I),I=1,ICOL)
124      5004 LIST=NUM+LVAR
125      KTEST=KTESK+KTESS
126      IF(KTESK)1122,1122,1120
127      1120 READ(5,1121)((AKVAL(I),I=1,KTESK)
128      1121  FORMAT(10F8.0)
129      1122 IF(KTESS)1124,1124,1123
130      1123 READ(5,1121)((SVAL(I),I=1,KTESS)
131      1124 CALL CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IPUNH
132      1,1VL,MAJTS,MACOL,LIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,IGSUB,KT
133      2ESK,KTESS,AKVAL,SVAL,AINC)
134      IF(ICOND)5006,5006,5005
135      5005 CALL MATRL(ICOND,NWELL,MAJTS,IPUNH(5))

```

```

136 5006 IF(I COL)5080,5080,5007
137 5007 CALL COLOR(I COL,NWELL,MACOL,IPUNH(4))
138 5080 IF(IGSUB)2,2,1
139 1 SUBDA=1.0
140 AMIN=9999.
141 GO TO 8002
142 2 IF(SUBDA)8000,8000,8002
143 8000 IF(ILVL)8002,8002,8001
144 8001 CALL WATLV(NWELL,IWELL,WATEL)
145 8002 IF(LIST)6004,6004,3014
146 3014 IM=1
147 C READS HEADERS OF LAYER VARIABLES FROM DISC
148 READ(3,IM)HEAD
149 DO 1003 K=1,2
150 J=0
151 C TEST FOR NUMBER OF VARIABLES TO BE SELECTED
152 IF(LVAR)903,903,902
153 902 DO 1002 JC=1,LVAR
154 C SELECTS HEADERS FOR VARIABLES
155 ISTRT=(I VAR(JC)*12-11)
156 IEND=ISTRT+11
157 DO 1001 L=ISTRT,IEND
158 J=J+1
159 1001 TITLE(K,J)=HEAD(K,L)
160 1002 CONTINUE
161 C TEST FOR ADDITIONAL LAYER VARIABLES
162 IF(NUM)1003,1003,903
163 903 DO 2002 JC=1,NUM
164 C SELECTS HEADERS FOR LAYER VARIABLES
165 ISTRT=(IADVR(JC)*12-11)
166 IEND=ISTRT+11
167 DO 2001 L=ISTRT,IEND
168 J=J+1
169 2001 TITLE(K,J)=HEAD(K,L)
170 2002 CONTINUE
171 1003 CONTINUE
172 C TEST ON SUBDATUM ELEV
173 IF(SUBDA)5016,5016,3012
174 5016 IF(ILVL)3013,3013,5017
175 C LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEVATION OF THE
176 C TOP OF A LAYER, AND ELEVATION OF THE TOP OF SATURATED ZONE.
177 5017 WRITE(6,109)
178 WRITE(6,5018)
179 5018 FORMAT('+', ' WN SUB LD L ELEV SATURATED ZONE')
180 GO TO 3013
181 3012 WRITE(6,109)
182 C LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEV OF TOP OF
183 C LAYER IN WHICH SUBDATUM IS FOUND
184 109 FORMAT('0')
185 WRITE(6,108)
186 108 FORMAT('+', ' WN SUB LD L ELEV')
187 3013 IEND=J
188 DO 1004 K=1,2
189 C WRITES HEADERS FOR VARIABLES
190 1004 WRITE(6,115)(TITLE(K,J),J=1,IEND)
191 115 FORMAT(' ',22X, 96A1)
192 ELV1=0.0
193 ICONT=0
194 JCONT=0
195 C SET BRANCH =1
196 C READ A TEST HOLE NUMBER TO BE SEARCHED
197 7001 SUB=SUBDA
198 ICONT=ICONT+1
199 IF(INC)1110,1110,1113
200 1110 IINC=1
201 GO TO 1114
202 1113 IINC=INC
203 1114 DO 1111 II=1,IINC
204 DO 10 IC=1,NWELL
205 LTEST=0
206 IBRN=1

```

```

207      ISEC=21
208      JBRN=2
209      SUBDA=SUB
210      IF(SUBDA)5000,5000,3001
211 5000 IF(ILVL)3001,3001,502
212 502 JBRN=1
213 C     READS TOTAL NUMBER OF LAYERS FOR EACH TEST HOLE FROM DISC
214 3001 READ (2)ISEC)WVAR
215      IKK=IWELL(IC)
216 C     BRANCHES TO DIFFERENT PARTS OF PROGRAM
217      GO TO(3002,3003,53),IBRN
218 C     SETS MAXLA EQUAL TO TOTAL NO. OF LAYERS FOR EACH TEST HOLE
219 3002 MAXLA=WVAR(IKK)
220      GO TO 3004
221 C     READS GROUND SURFACE ELEV FOR EACH TEST HOLE FROM DISC
222 3003 GSELV=WVAR(IKK)
223      GSURF=GSELV
224 C     SETS SECTOR TO FIND BEDROCK ELEV
225      ISEC=7
226 C     SET BRANCH = 3
227      IBRN=3
228      GO TO 3001
229 C     READS BEDROCK ELEV FOR EACH TEST HOLE FROM DISC
230 53 BEDRK=WVAR(IKK)
231 C     TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
232      IF(INC)3006,3006,9001
233 C     ESTABLISH SUBDATUM ELEV ABOVE BEDROCK
234 9001 SUBDA=BEDRK+AINC(II)
235      GO TO 3006
236 C     TEST IF SUBDATUM ABOVE BEDROCK EXISTS
237 3004 IF(SUBDA)9999,9999,3005
238 9999 IF(ILVL)9002,9002,3005
239 C     TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
240 9002 IF(INC)3006,3006,3005
241 C     SETS SECTOR TO SELECT GROUND SURFACE ELEV.
242 3005 ISEC=6
243 C     SET BRANCH = 2
244      IBRN=2
245      GO TO 3001
246 3006 IF(IGSUB)12001,12001,2000
247 2000 SUBDA=GSURF
248      SUBDA=SUBDA-(IGSUB*ICONT)
249      SUBTS=BEDRK
250      IF(SUBTS)2003,2003,2005
251 2003 WRITE(6,2004)IWELL(IC)
252 2004 FORMAT('0',25('*'),'NO BEDROCK ELEVATION FOR WELL ',14,25('*'),//)
253      GO TO 10
254 2005 IF(BEDRK-AMIN)2006,12001,12001
255 2006 AMIN=BEDRK
256 12001 ISEC2=IWELL(IC)
257      ILAY=1
258      READ (1)ISEC2)STRAT
259      SUM=0.0
260      THIK=0.0
261 7005 IWLL=IWELL(IC)
262 C     TEST IF TEST HOLE HAS A LOG
263 7006 IF(MAXLA)10,10,200
264 C     TEST HOLES WITH MORE THAN TWENTY LAYERS ARE WRITTEN ON PRINTER.
265 200 IF(MAXLA-20)203,203,202
266 202 WRITE(6,104)IWELL(IC)
267 104 FORMAT(' ',14,'LAYER NUMBER GREATER THAN 20 ON TEST HOLE ',14)
268      GO TO 10
269 C     READS THROUGH TEST HOLE LAYERS
270 203 IF(ILVL)9997,9997,5009
271 5009 SUBDA=WATEL(IKK)
272 9997 DO 90 JLAY=1,MAXLA
273 C     SUMS LAYER THICKNESS
274      SUM=SUM + STRAT(ILAY,2)
275 C     TEST IF SUBDATUM ELEV IS READ
276 5 CONTINUE
277 5008 IF(SUBDA)3008,3008,3007

```

```

278 3007 IF(SUBDA-GSELV)4016,4016,10
279 4016 IF(SUBDA-BEDRK)10,4017,4017
280 C SUBTRACT LAYER THICKNESS OFF GROUND SURFACE
281 4017 ELEV=GSELV-STRAT(ILAY,2)
282 C TEST NEW GROUND SURF AGAINST SUBDATUM ELEV
283 IF (ELEV-SUBDA)3010,3010,3009
284 C RESFTS GROUND SURFACE TO TOP OF NEXT LAYER
285 3009 GSELV=ELEV
286 C INCREASE LAYER NO. BY 1
287 ILAY=ILAY+1
288 GO TO 90
289 C COMPUTES DEPTH TO TOP OF LAYER CONTAINING SUBDATUM
290 3010 GO TO (5010,5012),JBRN
291 5010 JBRN=2
292 SUM=GSURF-SUBDA
293 STRAT(ILAY,2)=SUBDA-ELEV
294 ELEV=SUBDA
295 GSELV=SUBDA
296 SUM=SUM+STRAT(ILAY,2)
297 IF(KSAT)3007,3007,7008
298 7008 CALL KTESX(ILAY,S7,S8,AKV1,SV1)
299 5012 DTOLA=GSURF-GSELV
300 C TEST IF ADDITIONAL LAYER VARIABLES
301 3020 IF(NUM)3016,3016,3017
302 3017 DO 3015 IJJ=1,NUM
303 C SETS K TO ADDITIONAL LAYER VARIABLE
304 K=IADVR(IJJ)
305 C SETS IV TO THE NUMBER OF THE ADDITIONAL LAYER VARIABLES PLUS THE NUMBER OF
306 C LAYER VARIABLES TO BE SELECTED
307 IV=IJJ+LVAR
308 C STORES ADDITIONAL LAYER VARIABLES IN ARRAY
309 3015 VAR(IV)=STRAT(ILAY,K)
310 IF(LVAR)3016,3025,3016
311 3016 DO 3011 IJ=1,LVAR
312 C SETS K TO LAYER VARIABLE TO BE SELECTED
313 K=IVAR(IJ)
314 C STORES LAYER VARIABLES SELECTED IN ARRAY
315 3011 VAR(IJ)=STRAT(ILAY,K)
316 C COMPUTES DEPTH TO TOP OF LAYER WHICH CONTAINS SUBDATUM
317 3025 ELV=GSURF-(SUM-STRAT(ILAY,2))
318 C SETS IDT TO DEPTH TO LAYER
319 IDT=DTOLA
320 C SETS ISUB TO SUBDATUM ELEVATION
321 ISUB=SUBDA
322 IF(KSAT)300,300,7003
323 C TEST IF LOG OF ALL LAYERS IS WANTED
324 300 IF(ILog)7050,7050,7003
325 C WRITE DATA OUT FOR ALL LAYERS
326 7050 IF(lGSUB)7051,7051,7003
327 C LABELS SUBDATUM ELEVATION, DEPTH TO LAYER, ELEVATION OF TOP OF LAYER
328 C CONTAINING SUBDATUM, AND SELECTED VARIABLES.
329 7051 IF(ELV-ELV1)7003,10,7003
330 7003 WRITE (6,113) IWL, ISUB,IDT,ELV,(VAR(I),I=1,LIST)
331 113 FORMAT(' ',I3,I5,I4,F8.2,8F12.4)
332 C TEST FOR PUNCHED OUTPUT.
333 IF(IPTH(1))94,94,1050
334 1050 WRITE(7,1051)IWL,ISUB,IDT,ELV,(VAR(I),I=1,LIST)
335 1051 FORMAT(I3,I5,I4,F8.2,5F12.4,/,5F12.4)
336 94 IF(KSAT)301,301,93
337 301 IF(ILVL)10,10,95
338 95 ILAY=ILAY+1
339 C TEST LAYER VARIABLE VALUES SEARCHED.
340 C LVAR1 IS THE NUMBER OF VALUES SELECTED FOR EACH LAYER VARIABLE TESTED.
341 3008 IF(LVAR1)4018,4018,904
342 904 DO 6 JJ=1,LVAR
343 K=IVAR(JJ)
344 DO 6 J=1,LVAR1
345 C TEST DATA IN LAYER AGAINST TEST VALUE
346 IF(TVALU(J)=STRAT(JLAY,K))6,4011,6
347 6 CONTINUE
348 GO TO 9

```

```

349 C      TEST FOR ADDITIONAL LAYER VARIABLES
350 4011 THIK=THIK+STRAT(JLAY,2)
351 4018 IF(NUM)6003,6003,4010
352 4010 DO 8 IJ=1,NUM
353 K=IADVR(IJ)
354 C      SUMS NUMBER OF LAYER VARIABLES TESTED AND ADDITIONAL LAYER VARIABLES
355 IV=IJ+LVAR
356 8 VAR(IV)=STRAT(JLAY,K)
357 C      TEST ON NUMBER OF LAYER VARIABLES TO BE SEARCHED
358 6003 IF(ILVAR)6001,6001,6000
359 6000 DO 7 IJ=1,LVAR
360 C      SETS K TO THE VARIABLE TESTED
361 K=IVAR(IJ)
362 C      SETS VAR(IJ) TO THE VALUE STORED IN LAYER DATA
363 7 VAR(IJ)=STRAT(JLAY,K)
364 C      TEST ON VARIABLES TO BE SEARCHED FOR OR ADDITIONAL LAYER VARIABLES
365 6001 IF(LIST)6004,6004,6002
366 6002 IF(ILVL)6020,6020,9
367 6020 WRITE(6,103)IWLL,JLAY,(VAR(I),I=1,LIST)
368 103 FORMAT(' ',10X,2I5,8F12.4)
369 C      TEST FOR PUNCHED OUTPUT
370 IF(IPUNH(1))9,9,6006
371 6006 WRITE(7,6007)IWLL,JLAY,(VAR(IJ),IJ=1,LIST)
372 6007 FORMAT(2I4,8F9.2/,8X,8F9.2/,8X,5F9.2)
373 C      RETURN TO READ NEXT LAYER
374 9 IF(KTEST)90,90,6008
375 6008 IF(ILVL)92,92,91
376 91 KLAY=JLAY-1
377 GO TO 920
378 92 KLAY=JLAY
379 C      SUBROUTINE KTESX COMPUTES AVERAGE PERMEABILITY AND STORAGE COEFFICIENT
380 C      VALUES.
381 920 CALL KTESX(KLAY,S7,S8,AKV1,SV1)
382 90 CONTINUE
383 93 IF(KTEST)6011,6011,6009
384 6009 AKV1=AKV1/S7
385 SV1=SV1/S8
386 WRITE(6,6010)IWLL,AKV1,SV1
387 6010 FORMAT(' ','HOLE NUMBER= ',I4/, ' WGT. AVE. PERM.= ',F10.0/, ' WGT.
388 1AVE. STORAGE COEFFICIENT= ',F10.3)
389 IF(IPUNH(6))6011,6011,11100
390 11100 WRITE(7,11101)IWLL,AKV1,SV1
391 11101 FORMAT(I4,F5.0,F5.3)
392 C      RETURN TO READ NEXT TEST HOLE
393 6011 IF(LVAR)10,10,4019
394 4019 WRITE(6,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
395 161 FORMAT(' ','HOLE NO. ',I5, ' NET THICK ',F12.0, ' CODES ',5X,6F4.0)
396 IF(IPUNH(2))10,10,4020
397 C      PUNCHES DATA ON CARDS
398 4020 WRITE(7,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
399 10 CONTINUE
400 1111 CONTINUE
401 C      TEST IF SUBDATUM ELEVATION IS SELECTED
402 6005 IF(ILVL)99,99,98
403 98 SUBDA=0.0
404 99 IF(SUBDA)6004,6004,7000
405 C      TEST IF POINT ABOVE BEDROCK IS SELECTED
406 7000 IF(INC)9003,9003,6004
407 C      STEP DOWN SUBDATUM TO BE SEARCHED
408 9003 IF(IGSUB)9004,9004,9005
409 9004 SUBDA=SUBDA-SUBIN
410 IF(SUBDA-SUBTS)6004,6004,7002
411 7002 ELV1=ELV
412 GO TO 7001
413 C      TEST IF SUBDATUM WANTED IS BELOW LOWER LIMIT
414 9005 IF(SUBDA-AMIN)6004,6004,7001
415 C      RESET ELEVATION OF TOP OF LAYER
416 C      TEST IF ADDITIONAL TEST HOLE VARIABLES ARE SELECTED
417 6004 IF(INVAR)1011,1011,11
418 C      SET DISC SECTOR
419 11 IM=3

```

```

420 C READ HEADERS FOR ADDITIONAL TEST HOLE VARIABLES
421 READ (3'IM) HEAD
422 JSTRT=1
423 JEND=9
424 DO 1009 IL=1,3
425 C TEST IF NUMBER IS MORE THAN NINE
426 IF (NVAR-JEND)1010,1010,12
427 C SETS NUMBER OF VARIABLES TO BE WRITTEN
428 1010 JEND=NVAR
429 12 DO 1007 K=1,2
430 J=0
431 C READS NINE HEADERS FROM DISC STORAGE
432 DO 1006 JC=JSTRT,JEND
433 ISTRT=(ISTOR(JC)*12-11)
434 IEND=ISTRT+11
435 DO 1005 L=ISTRT,IEND
436 J=J+1
437 1005 TITLE(K,J)=HEAD(K,L)
438 1006 CONTINUE
439 1007 CONTINUE
440 IEND=J
441 DO 1008 K=1,2
442 C WRITES NINE HEADERS ON EACH PRINTER LINE
443 1008 WRITE (6,105) (TITLE (K,J),J=1,IEND)
444 105 FORMAT(' ',108A1)
445 C TEST IF SUBDATUM ELEVATION IS SELECTED
446 DO 22 J=1,NWELL
447 DO 20 I=JSTRT,JEND
448 C STORES SELECTED VARIABLES ON DISC
449 ISEC1=ISTOR(I)
450 C READS VARIABLES FROM DISC
451 READ (2'ISEC1)WVAR
452 C SETS IK TO TEST HOLE NUMBER
453 IK=IWELL(J)
454 C SETS IKK TO VARIABLE
455 IKK=ISTOR(I)
456 V(IKK)=WVAR(IK)
457 20 CONTINUE
458 DO 21 I=JSTRT,JEND
459 K=ISTOR(I)
460 21 VV(I)=V(K)
461 C WRITES VARIABLES FOUND AT SUBDATUM ON PRINTER
462 WRITE (6,5400) (VV(I),I=JSTRT,JEND)
463 5400 FORMAT(' ',9F12.3)
464 C TEST FOR PUNCHED OUTPUT
465 IF(IPUNH(3))22,22,1054
466 1054 WRITE(7,1055) (VV(I),I=JSTRT,JEND)
467 1055 FORMAT(6F12.3,/,6F12.3,/,6F12.3,/,3F12.3)
468 C PUNCHES VARIABLES FOUND AT SUBDATUM, SIX PER CARD
469 22 CONTINUE
470 C TEST IF ALL VARIABLES SELECTED HAVE BEEN WRITTEN
471 IF (JEND=NVAR)23,1011,1011
472 C RESET TO NEXT NINE HEADINGS AND VARIABLES
473 23 JSTRT=JEND+1
474 JEND=JEND+9
475 1009 CONTINUE
476 1011 CONTINUE
477 GO TO 1012
478 1013 STOP
479 END
480 C
481 C
482 C SUBROUTINE CODE DISPLAYS A LIST OF OPTIONS SELECTED BY THE USER.
483 C RETRIEVAL CONTROL CARD CODING IS DISPLAYED ON PRINTER FOR EACH JOB SETUP.
484 SUBROUTINE CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IOAT,INC,ILOG
485 1,IPUNH,ILVL,MAJTS,MACOL,ILIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,I
486 2GSUB,KTESK,KTESS,AKVAL,SVAL,AINC)
487 DIMENSION AKVAL(10),SVAL(10),AINC(20)
488 DIMENSION MAJTS(10),MACOL(10),ISTOR(21),IADVR(8),IPUNH(6)
489 COMMON IWELL(1000),IVAR(8),TVALU(8)
490 WRITE(6,120)

```

```

491 120 FORMAT('1',' IF TEST CODES ARE EQUAL TO 1, THEN TEST IS USED, IF E
492 1QUAL TO 0, THEN TEST IS BY-PASSED',//)
493 WRITE(6,100) NWELL
494 100 FORMAT(' ','NUMBER OF TEST HOLES TO BE SEARCHED= ',I3)
495 WRITE(6,133)(IWELL(I),I=1,NWELL)
496 133 FORMAT(' ','TEST HOLES THAT ARE BEING TESTED ARE',/,41(24I5,//))
497 WRITE(6,101) LVAR
498 101 FORMAT('0','NUMBER OF LAYER VARIABLES TO BE TESTED= ',I2)
499 IF (LVAR)2,2,1
500 1 WRITE(6,102)(IVAR(I),I=1,LVAR)
501 102 FORMAT(' ','THE VARIABLES THAT ARE TO BE TESTED ARE',/,8I5)
502 2 WRITE(6,103) LVAR1
503 103 FORMAT('0','NUMBER OF TEST VALUES= ',I2)
504 IF(LVAR1)4,4,3
505 3 WRITE(6,104)(TVALU(I),I=1,LVAR1)
506 104 FORMAT(' ','TEST VALUES OF EACH LAYER ARE',/,8F10.4)
507 4 WRITE(6,105) NUM
508 105 FORMAT('0','NUMBER OF ADDITIONAL LAYER VARIABLES= ',I2)
509 IF(NUM)6,6,5
510 5 WRITE(6,106)(IADVR(I),I=1,NUM)
511 106 FORMAT(' ','ADDITIONAL LAYER VARIABLES ARE',/,8I5)
512 6 WRITE(6,116) ILIST
513 116 FORMAT('0','TOTAL NUMBER OF LAYER VARIABLES THAT ARE CALLED= ',I2)
514 WRITE(6,107) NVAR
515 107 FORMAT('0','NUMBER OF TEST HOLE VARIABLES= ',I2)
516 IF(NVAR)8,8,7
517 7 WRITE(6,108)(ISTOR(I),I=1,NVAR)
518 108 FORMAT(' ','THE TEST HOLE VARIABLES ARE',/,21I5)
519 8 WRITE(6,109) IDAT
520 109 FORMAT('0','SUBDATUM ELEVATION CODE= ',I2)
521 IF(IDAT)10,10,9
522 9 WRITE(6,110) SUBDA,SUBTS,SUBIN
523 110 FORMAT(' ','ELEVATION TO BE SEARCHED= ',F10.0,/, ' ELEVATION TO TER
524 1MINATE SEARCHING= ',F10.0,/, ' STEP-DOWN INCREMENT= ',F10.0)
525 10 IF(INC)132,132,130
526 130 WRITE(6,131) INC,(AINC(I),I=1,INC)
527 131 FORMAT('0'NUMBER OF HEIGHT INCREMENTS ABOVE BEDROCK TO BE SEARCHED
528 1= ',I2,/, ' THE INCREMENT VALUES ARE',/,20F10.2)
529 132 WRITE(6,112) ICOND
530 112 FORMAT('0','TEST IF MAJOR OR MINOR LITHOLOGY TYPE WANTED= ',I2)
531 IF(ICOND)12,12,11
532 11 WRITE(6,113)(MAJTS(I),I=1,ICOND)
533 113 FORMAT(' ','LITHOLOGY TYPE CODES ARE',/,8I5)
534 12 WRITE(6,114) ICOL
535 114 FORMAT('0','TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED=',I3)
536 IF(ICOL)14,14,13
537 13 WRITE(6,115)(MACOL(I),I=1,ICOL)
538 115 FORMAT(' ','LITHOLOGY COLOR CODES ARE',/,8I5)
539 14 WRITE(6,117) ILVL
540 117 FORMAT('0','TEST IF WATERLEVEL OF SATURATED ZONE IS TO BE USED= ',
541 112)
542 WRITE(6,121) K SAT
543 121 FORMAT('0' TEST IF SATURATED ZONE IS TO BE LOGGED= ',I2)
544 WRITE(6,118) ILOG
545 118 FORMAT('0','TEST IF ALL LAYERS ARE TO BE LOGGED= ',I2)
546 IF(IGSUB)124,124,122
547 122 WRITE(6,129) IGSUB
548 123 FORMAT('0' STEP DOWN INCREMENT FROM GROUND SURFACE ELEVATION= ',I2,
549 1' FEET')
550 124 IF(KTESK)129,129,125
551 125 WRITE(6,126) KTESK
552 126 FORMAT('0'NUMBER OF K-PERMEABILITY AND S-STORAGE COEF. VALUES= ',I2
553 1)
554 WRITE(6,127)(AKVAL(I),I=1,KTESK)
555 127 FORMAT(' ','THE K-PERMEABILITY VALUES ARE',/,10F8.0)
556 WRITE(6,128)(SVAL(I),I=1,KTESK)
557 128 FORMAT(' ','THE S-STORAGE COEF. VALUES ARE',/,10F8.3)
558 129 WRITE(6,119)(IPUNH(I),I=1,6)
559 119 FORMAT('0','TEST FOR PUNCHING DATA',/,5X,'LAYER DATA= ',I2,/,5X,'
560 1NET THICKNESS= ',I2,/,5X,'TEST HOLE DATA= ',I2,/,5X,'COLOR OF LITHOLOGY=
561 1 ',I2,/,5X,'MATERIAL TYPE OF LITHOLOGY= ',I2,/,5X,' WGT. AVE. PERM

```



```

562      2. AND WGT. AVE. STOR. COEF.= 'I2)
563      RETURN
564      END
565  C
566  C
567  C      SUBROUTINE KTESX COMPUTES AVERAGE K AND S VALUES WEIGHTED ON LAYER
568  C      THICKNESS
569      SUBROUTINE KTESX(ILAY,S7,S8,AKV1,SV1)
570      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
571      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
572      COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
573      IF(LTEST)10,10,15
574      10 S7=0.0
575          S8=0.0
576          AKV1=0.0
577          SV1=0.0
578          LTEST=LTEST+1
579      15 J7=STRAT(ILAY,7)
580          J8=STRAT(ILAY,6)
581          IF(J7)21,21,20
582      20 S7=S7+STRAT(ILAY,2)
583          AKV1=AKV1+(AKVAL(J7)*STRAT(ILAY,2))
584      21 IF(J8)26,26,25
585      25 S8=S8+STRAT(ILAY,2)
586          SV1=SV1+(SVAL(J8)*STRAT(ILAY,2))
587      26 RETURN
588      END
589  C
590  C
591      SUBROUTINE COLOR(ICOLR,NWELL,MACOL,IPUNH)
592  C      SUBROUTINE TO READ AND TEST FOR MAJOR OR MINOR COLOR OF LITHOLOGY
593      DIMENSION MACOL(10)
594      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
595      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
596      COMMON ISEC,ISEC1,ISEC2
597      100 FORMAT(' ','HOLE NO.',2X,'LAYER NO.',2X,'MAJOR COLOR',2X,'MINOR CO
598          1LOR',4X,'ELEV ',3X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR) NE
599          2T THICK(MINOR)')
600      101 FORMAT(' ',2X,I3,8X,I2,10X,I2,20X,F6.1,2XF6.1,6X,F6.2)
601      102 FORMAT(' ',2X,I3,8X,I2,23X,I2,7X,F6.1,2X,F6.1,6X,F6.2)
602      103 FORMAT('+',80X,F6.2)
603      104 FORMAT('+',99X,F6.2)
604  C      WRITE HEADERS FOR COLORS FOUND IN LITHOLOGY
605      WRITE(6,100)
606  C      ICOLR IS THE NUMBER OF COLORS SELECTED
607      DO 6 K=1,ICOLR
608  C      MACOL(K) IS THE NUMERICAL CODE FOR EACH COLOR SELECTED
609          JTEST=MACOL(K)
610  C      NWELL IS THE NUMBER OF TEST HOLES TO BE SEARCHED
611          DO 5 IC=1,NWELL
612  C      CALLS SUBROUTINE NAMED 'SERCH'
613          CALL SERCH(NLAY,GSELV,IC)
614  C      SETS SECTOR TO TEST HOLE NO. BEING SEARCHED
615          ISEC2=IWELL(IC)
616  C      READS FROM DISC LAYER DATA
617          READ (1,ISEC2)STRAT
618          SUM=0.0
619          SUM2=0.0
620          SUM3=0.0
621          J=1
622  C      SETS IWLL TO TEST HOLE NO. BEING SEARCHED
623      52 IWLL=IWELL(IC)
624  C      READS LAYER DATA FOR ALL LAYERS IN EACH TEST HOLE
625      53 DO 4 JJ=1,NLAY
626  C      SETS TYPE TO COLOR OF LAYER
627      50 TYPE=STRAT(J,4)
628  C      SETS THICK TO THICKNESS OF LAYER BEING SEARCHED
629          THICK=STRAT(J,2)
630  C      SUMS LAYER THICKNESS OF ALL LAYERS AS SEARCHED
631          SUM=SUM+STRAT(J,2)
632  C      KTEST IS A THREE DIGIT NUMBER (COLOR CODE) OF LAYER

```

```

633      KTEST= IFIX(TYPE)/10
634      C      TEST IF COLOR IN LAYER IS SELECTED COLOR
635      IF (KTEST=JTEST) 2, 1, 2
636      C      SUM1 IS THE THICKNESS TO TOP OF LAYER WHERE COLOR IS FOUND
637      1 SUM1=SUM-STRAT(J,2)
638      SUM2=SUM2+THICK
639      C      COMPUTES ELEVATION OF TOP OF LAYER WHERE COLOR IS FOUND
640      ELEV=GSELV-SUM1
641      C      ICOL IS TWO NUMBER CODE
642      ICOL = TYPE
643      C      LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH TO
644      C      LAYER, LAYER THICKNESS
645      WRITE(6,101)IWLL, JJ,ICOL,ELEV,SUM1,THICK
646      C      TEST FOR PUNCHED OUTPUT
647      IF(IPUNH)4,4,10
648      C      PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV. OF TOP OF LAYER, DEPTH
649      C      TO LAYER, LAYER THICKNESS ON ONE CARD
650      10 WRITE(7,11)IWLL,JJ,ICOL,ELEV,SUM1,THICK
651      11 FORMAT(' COLOR1 ',3I5,F6.1,2X,F6.1,6X,F6.2)
652      GO TO 4
653      2 KTEST=TYPE-FLOAT(KTEST)*10.
654      C      TEST IF COLOR ASKED FOR IS MINOR COLOR
655      IF(KTEST=JTEST)4,3,4
656      C      CALCULATES DEPTH TO TOP OF LAYER
657      3 SUM1=SUM-STRAT(J,2)
658      SUM3=SUM3+THICK
659      C      CALCULATES ELEV. TOP OF LAYER
660      ELEV=GSELV-SUM1
661      C      ICOL IS A TWO NUMBER CODE
662      ICOL=TYPE
663      C      LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
664      C      TO LAYER, LAYER THICKNESS
665      WRITE(6,102)IWLL, JJ,ICOL,ELEV,SUM1,THICK
666      IF(IPUNH)4,4,12
667      C      PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
668      C      TO LAYER, LAYER THICKNESS ON ONE CARD
669      12 WRITE(7,13)IWLL,JJ,ICOL,ELEV,SUM1,THICK
670      13 FORMAT(' COLOR2 ',3I5,F6.1,2X,F6.1,6X,F6.2)
671      4 J=J+1
672      IF(SUM2)55,55,54
673      54 WRITE(6,103)SUM2
674      55 IF(SUM3)5,5,56
675      56 WRITE(6,104)SUM3
676      5 CONTINUE
677      6 CONTINUE
678      RETURN
679      END
680      C
681      C
682      SUBROUTINE SERCH(NLAY,GSELV,IC)
683      C      SUBROUTINE READS FROM DISC (1) TOTAL NO. OF LAYERS, (2) GROUND
684      C      SURFACE ELEVATION FOR SELECTED TEST HOLE
685      COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
686      COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
687      COMMON ISEC,ISEC1,ISEC2
688      C      SET SECTOR NUMBER TO READ TOTAL NO. OF LAYERS FROM DISC
689      IBRN=0
690      ISEC=21
691      3001 READ(2,ISEC)WVAR
692      IKKK=IWELL(IC)
693      IF(IBRN)10,10,3002
694      10 NLAY=WVAR(IKKK)
695      C      SET SECTOR NUMBER TO READ GROUND SURFACE ELEV. FROM DISC
696      ISEC=6
697      IBRN=1
698      GO TO 3001
699      C      SETS GSELV TO GROUND SURFACE ELEVATION
700      3002 GSELV=WVAR(IKKK)
701      RETURN
702      END
703      C

```

```

704 C
705 SUBROUTINE MATRL (ICOND,NWELL,MAJTS,IPUNH)
706 C SUBROUTINE SELECTS MAJOR AND MINOR MATERIAL TYPE OF
707 C LITHOLOGY
708 DIMENSION MAJTS (10)
709 COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
710 COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
711 COMMON ISEC,ISEC1,ISEC2
712 100 FORMAT(' ', 'HOLE NO.',2X,'LAYER NO',2X,'MAJOR TYPE',3X, 'MINOR TY
713 1PE',5X,'ELEV',4X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR) NET
714 2THICK(MINOR)')
715 101 FORMAT(' ',2X,I3,8X,I2,10X,I5,18X,F6.1,2X,F6.1,6X,F6.2)
716 102 FORMAT(' ',2X,I3,8X,I2,22X,I5,6X,F6.1,2X,F6.1,6X,F6.2)
717 103 FORMAT('+',80X,F6.2)
718 104 FORMAT('+',99X,F6.2)
719 WRITE(6,100)
720 C ICOND IS THE NUMBER OF MATERIAL TYPES SELECTED,
721 DO 6 K=1,ICOND
722 C SETS JTEST EQUAL TO MATERIAL CODE SELECTED (2 DIGIT)
723 JTEST=MAJTS(K)
724 C SEARCH THROUGH EACH SELECTED TEST HOLE
725 DO 5 IC=1,NWELL
726 C CALLS SUBROUTINE SERCH
727 CALL SERCH (NLAY,GSELV,IC)
728 ISEC2=IWELL(IC)
729 C READ LAYER DATA FROM DISC FOR EACH HOLE
730 READ (1,ISEC2)STRAT
731 SUM=0.0
732 J=1
733 SUM2=0.0
734 SUM3=0.0
735 52 IWLL=IWELL(IC)
736 C SEARCH ALL LAYERS IN EACH HOLE
737 DO 4 JJ=1,NLAY
738 C SET TYPE EQUAL TO MATERIAL CODE FOR EACH LAYER (5 DIGIT)
739 50 TYPE=STRAT(J,3)
740 C SUM IS THE TOTAL THICKNESS INCLUDING THE LAYER BEING SEARCHED
741 SUM=SUM+STRAT(J,2)
742 C SETS KTEST TO A TWO DIGIT CODE OF MAJOR MATERIAL TYPE
743 KTEST=IFIX(TYPE)/1000
744 C THICK IS THE THICKNESS OF LAYER BEING SEARCHED
745 THICK=STRAT(J,2)
746 C TEST IF MAJOR MATERIAL TYPE IS IN SELECTED LAYER
747 ID1=TYPE/10000.
748 IF((ID1-2)1002,30,1002)
749 30 ITYPE=TYPE/1000.
750 ID2=ITYPE-(ITYPE/10*10)
751 IF((ID2-2)34,31,34)
752 31 ITEST=ID2+10
753 1000 IF((ITEST-JTEST)32,1,32)
754 32 ITYPE=TYPE/10.
755 ID4=ITYPE-(ITYPE/10*10)
756 1001 IF((ID4-2)35,33,35)
757 33 ITEST=ID4+10
758 IF((ITEST-JTEST)4,1,4)
759 34 ITYPE=TYPE/100.
760 ID23=ITYPE-(ITYPE/100*100)
761 IF((ID23-JTEST)1001,1,1001)
762 35 ITYPE=TYPE
763 ITEST=ITYPE-(ITYPE/100*100)
764 IF((ITEST-JTEST)4,1,4)
765 1002 IF(KTEST-JTEST)2,1,2
766 C SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MAJOR TYPE IS FOUND
767 1 SUM1=SUM-STRAT(J,2)
768 C SUM2 IS THE TOTAL THICKNESS OF LAYERS WITH MAJOR TYPE
769 SUM2=SUM2+THICK
770 C ELEV IS ELEVATION OF TOP OF LAYER CONTAINING MAJOR TYPE
771 ELEV=GSELV-SUM1
772 C SETS TYPE TO AN INTEGER NUMBER
773 ITYPE=TYPE
774 C LABELS HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF

```

```

775 C     LAYER, DEPTH TO LAYER, LAYER THICKNESS
776     WRITE(6,101) IWLL, JJ, ITYPE, ELEV, SUM1, THICK
777 C     TEST FOR PUNCHED OUTPUT
778     IF(IPUNH)4,4,7
779 C     PUNCHES HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF
780 C     LAYER, DEPTH TO LAYER, LAY THICK
781     7 WRITE(7,8) IWLL, JJ, ITYPE, ELEV, SUM1, THICK
782     8 FORMAT('MAJOR',3I6,2F8.1,F10.2)
783     GO TO 4
784 C     BREAK DOWN TYPE OF MATERIAL CODE TO TWO DIGITS
785     2 INUM=TYPE/1000.
786     ITYPE=TYPE
787 C     BREAK DOWN TYPE OF MATERIAL CODE TO MINOR TYPE ONLY
788 C     TEST IF MINOR TYPE OF MATERIAL CODE CALLED IS IN LAYER
789     INUM=TYPE-(FLOAT(INUM)*1000.)
790     IADJ=INUM/100
791     IF(IADJ-1)21,20,21
792     20 KTEST=INUM/10
793     GO TO 22
794     21 KTEST=INUM-(IADJ*100)
795     22 IF(KTEST-JTEST)4,3,4
796 C     SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MINOR TYPE CODE IS FOUND
797     3 SUM1=SUM-STRAT(J,2)
798     SUM3=SUM3+THICK
799 C     ELEV IS THE ELEVATION OF TOP OF LAYER WHERE MINOR TYPE IS FOUND
800     ELEV=GSELV-SUM1
801 C     LABELS WELL NO., LAYER NO., MINOR MATERIAL TYPE, ELEV OF TOP OF
802 C     LAYER, LAYER THICK
803     WRITE(6,102) IWLL, JJ, ITYPE, ELEV, SUM1, THICK
804     IF(IPUNH)4,4,9
805     9 WRITE(7,10) IWLL, JJ, ITYPE, ELEV, SUM1, THICK
806     10 FORMAT('MINOR',3I6,2F8.1,F10.2)
807     4 J=J+1
808 C     TEST IF NET THICKNESS OF LAYERS WITH MAJOR MATERIAL IS SELECTED
809     IF(SUM2)55,55,54
810 C     WRITE NET THICKNESS OF LAYERS WITH MAJOR MATERIAL TYPE
811     54 WRITE(6,103) SUM2
812     55 IF(SUM3)5,5,56
813     56 WRITE(6,104) SUM3
814     5 CONTINUE
815     6 CONTINUE
816     RETURN
817     END
818 C
819 C
820     SUBROUTINE TAPES
821 C     SUBROUTINE TAPES READS TAPES USED IN STORAGE AND RETRIEVAL PROGRAM
822 C     TAPE NUMBER 8 FOR WELL VARIABLE DATA.
823 C     TAPE DRIVE NUMBER 9 FOR LAYER DATA.
824     COMMON IWELL(1000), IVAR(8), TVALU(8), IADV(8), WVAR(1000), Istor(21)
825     COMMON HEAD(2,252), TITLE(2,108), JWELL(1000), IADVR(8), STRAT(20,8)
826     COMMON ISEC, ISEC1, ISEC2
827     ISEC1=1
828     DO 10 I=1,21
829 C     READS TEST HOLE DATA VARIABLES FROM TAPE
830     READ(8,END=11) WVAR
831 C     WRITES TEST HOLE DATA ON DISC FILE
832     10 WRITE(2'ISEC1) WVAR
833     11 DO 20 J=1,1000
834 C     READS LAYER DATA VARIABLES FROM TAPE
835     READ(9,END=30) IM,I,STRAT
836 C     SELECTS LAYER VARIABLES FOR SPECIFIED TEST HOLES
837     IF(IM)30,30,20
838 C     WRITE(LAYER DATA ON DISC)
839     20 WRITE(1'IM) STRAT
840     30 RETURN
841     END
842 C
843 C
844 C     SUBROUTINE JULDY COMPUTES JULIAN DATE FROM CALENDAR DATE AND MILITARY
845 C     TIME.

```

```

846      SUBROUTINE JULDY (IMO,IDY,IYR,IHR,TIME)
847      NYR=IYR/4
848      NYR=NYR*4
849      IF (NYR-IYR) 2,1,2
850      1 IB=1
851      GO TO 3
852      2 IB=2
853      3 JDAY=0
854      DO 10 I=1,IMO
855      GO TO (4,5,6,5,9,5,9,5,5,9,5,9),I
856      4 MO=0
857      GO TO 10
858      5 MO=31
859      GO TO 10
860      6 GO TO (7,8),IB
861      7 MO=29
862      GO TO 10
863      8 MO=28
864      GO TO 10
865      9 MO=30
866      10 JDAY=JDAY+MO
867      JDAY=JDAY+IDY
868      DAY=JDAY-1
869      DAY=DAY*1440.
870      HR=(IHR/100)*60
871      HR1=IHR-((IHR/100)*100)
872      TIME=DAY+HR+HR1
873      102 RETURN
874      END
875      C
876      C
877      C      SUBROUTINE WATLV COMPUTES GROUND WATER ELEVATION AT SELECTED TEST HOLES
878      C      WHEN DATA FROM THE SATURATED ZONE IS RETRIEVED
879      C      SUBROUTINE WATLV(NWELLS,IWELL,WATEL)
880      C      WATER LEVEL PROGRAM COMPUTES AVERAGE GROUND WATER ELEVATION FOR A SELECTED
881      C      TIME PERIOD.
882      C      DIMENSION IWELL(1000),WATEL(1000)
883      C      REWIND 4
884      C      JWELL=0
885      C      BEGINNING (IMO, IDY, IYR, ITIM) AND ENDING (JMO, JDY, JYR, JTIM) MONTH,
886      C      DAY, YEAR, MILITARY TIME OF PERIOD FOR WHICH AVERAGE WATER LEVEL IS
887      C      COMPUTED IS READ FROM DATA CARD
888      C      1 READ(5,101)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
889      C      101 FORMAT(16I5)
890      C      WRITE(6,110)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
891      C      110 FORMAT('0',25('*'),'TIME PERIOD FOR SEASONAL ',I2,'/',I2,'/',I2,'/
892      C      1',I4,' TO ',I2,'/',I2,'/',I2,'/',I4,1X,25('*'))/)
893      C      IIYR=IYR
894      C      IF(IMO)107,107,5
895      C      SUBROUTINE JULDY COMPUTES TIME IN MINUTES FROM MONTH, DAY, YEAR, AND
896      C      MILITARY TIME
897      C      BTIM-BEGINNING TIME (JULIAN DATE IN MINUTES) OF PERIOD FOR WHICH WATER
898      C      LEVELS ARE AVERAGED
899      C      5 CALL JULDY(IMO,IDY,IYR,ITIM,BTIM)
900      C      IF(IYR-JYR)2,3,3
901      C      EYEAR-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED CROSSES END OF YEAR
902      C      THEN EYEAR (END OF FIRST YEAR, JULIAN DATE IN MINUTES) IS CALUCLATED
903      C      2 CALL JULDY(12,31,IYR,2359,EYEAR)
904      C      500 IIYR=IIYR+1
905      C      IF(IIYR-JYR)501,502,502
906      C      STIME-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED SPANS A FULL YEAR
907      C      THAT YEARS TIME (JULIAN DATE IN MINUTES) IS CALCULATED
908      C      501 CALL JULDY(12,31,IIYR,2359,STIME)
909      C      EYEAR=EYEAR+STIME
910      C      GO TO 500
911      C      EETIM-THE JULIAN DATE IN MINUTES FROM JANURARY 1 OF THE FINAL YEAR TO THE
912      C      END OF THE SELECTED TIME PERIOD
913      C      502 CALL JULDY(JMO,JDY,JYR,JTIM,EETIM)
914      C      ETIME=EETIM
915      C      ETIM=EETIM+EYEAR
916      C      GO TO 6

```

```

917 C      ETIM=END OF SELECTED PERIOD (JULIAN DATE IN MINUTES)
918      3 CALL JULDY(JMO,JDY,JYR,JTIM,ETIM)
919      ETIME=ETIM
920 C      TTIM-TOTAL TIME (MINUTES) OF SELECTED TIME PERIOD
921      6 TTIM=ETIM-BTIM
922 C      RATE OF WATER LEVEL CHANGE IS COMPUTED FROM ELEVATIONS READ FROM TAPE
923 C      WITHIN THE SELECTED TIME PERIOD,
924      DO 1110 I=1,NWELLS
925      IF(IWELL(I)-JWELL1)/7,1000,8
926      7 REWIND 4
927      JWELL1=0
928      8 KKK=IWELL(I)
929      JBRN=1
930      JBN=1
931      STIM=0.0
932      SGH=0.0
933      TIMZ=0.0
934      TM=0.0
935      10 READ(4,END=107) NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV
936      IF(NWELL-IWELL(I))/10,20,85
937      20 CALL JULDY(NMO,NDY,NYR,NTIM,TIME)
938      GO TO(3000,3001),JBRN
939      3000 JBRN=2
940      IF(IYR-NYR)/86,30,3010
941      3001 IF(IYR-NYR)/40,30,3010
942      30 IF(BTIM-TIME)/3003,3002,3010
943      3002 WGH=0.0
944      ELEV2=ELEV
945      TIMEB=TIME
946      GO TO 3011
947      3003 IF(NYR1-NYR)/3005,3004,3004
948      3004 JBN=2
949      GO TO 40
950      3005 JBN=3
951      GO TO 40
952      3010 NYR1=NYR
953      GO TO 10
954      40 BACKSPACE 4
955      BACKSPACE 4
956      READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
957      CALL JULDY(NMO,NDY,NYR,NTIM,TIMA)
958      45 READ(4,END=107)KWELL,KCODE,KYR,KMO,KDY,KTIM,ELEV2
959      IF(KWELL-IWELL(I))/86,46,87
960      46 IF((KYR-NYR)-1)/3014,3013,3012
961 C      A BREAK IN RECORD GREATER THAN ONE YEAR IS PRINTED IN OUTPUT
962      3012 WRITE(6,109)IWELL(I),NMO,NDY,NYR,NTIM,KMO,KDY,KYR,KTIM
963      109 FORMAT(' WELL NUMBER ',I4,' BREAK IN RECORD FROM ',I3,I5,' TO ',
964      I3,I5)
965      GO TO 1005
966      3013 IF(KMO+(12-NMO)-12)/3014,3012,3012
967      3014 CALL JULDY(KMO,KDY,KYR,KTIM,TIMEB)
968      GO TO(206,207,3006),JBN
969      3006 CALL JULDY(12,31,NYR,2359,TM)
970      DIFF=(TM-TIMA)+BTIM)+(TIMEB-BTIM)
971      DIFF1=TIMEB-BTIM
972      GO TO 208
973      206 CALL JULDY(12,31,NYR,2359,TM)
974      DIFF=(TM-TIMA)+TIMEB
975      DIFF1=(TM-BTIM)+TIMEB
976      GO TO 208
977      207 DIFF=TIMEB-TIMA
978      DIFF1=TIMEB-BTIM
979      208 SLOPE=(ELEV2-ELEV1)/DIFF
980      GHA=ELEV2-(SLOPE*DIFF1)
981      DIFF=DIFF1
982      STIM=STIM+DIFF
983      IF(STIM-TTIM)/1002,1011,1010
984      1010 DIFF=DIFF-(TM-ETIM+TIMEB)
985      GHB=ELEV2-SLOPE*(TM-ETIM+TIMEB)
986      GO TO 1012
987      1011 GHB=ELEV2-SLOPE*(TIMEB-ETIM)

```

```

988 1012 WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
989 GO TO 9001
990 1002 GHB=ELEV2
991 WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
992 3011 SGH=SGH+WGH
993 GHA=ELEV2
994 TIMZ=TIMEB
995 50 READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,GHB
996 IF(NWELL-IWELL(I))86,51,87
997 51 CALL JULDY(NMO,NDY,NYR,NTIM,TIMX)
998 IF(TIMZ-TIMX)201,201,200
999 200 CALL JULDY(12,31,NYR-1,2359,TM)
1000 DIFF=((TM-TIMZ)+TIMX)
1001 GO TO 203
1002 201 DIFF=TIMX-TIMZ
1003 203 STIM=STIM+DIFF
1004 IF(STIM-TTIM)55,800,70
1005 55 WGH=(((GHB+GHA)*.5)*DIFF)/TTIM
1006 SGH=SGH+WGH
1007 GHA=GHB
1008 TIMZ=TIMX
1009 GO TO 50
1010 800 WGH=(((GHB+GHA)*.5)*DIFF)/TTIM
1011 GHA=GHB
1012 TIMZ=TIMX
1013 GO TO 9001
1014 70 BACKSPACE 4
1015 80 BACKSPACE 4
1016 READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
1017 IF(NWELL-IWELL(I))86,81,87
1018 81 GHA=ELEV1
1019 CALL JULDY(NMO,NDY,NYR,NTIM,TIMEA)
1020 READ(4,END=107)NWELL,NCODE,NYR1,NMO,NDY,NTIM,ELEV2
1021 CALL JULDY(NMO,NDY,NYR1,NTIM,TIMEB)
1022 IF(NYR1-NYR)805,805,801
1023 801 CALL JULDY(12,31,NYR,2359,TM1)
1024 DIFF=(TM1-TIMEA)+TIMEB
1025 SLOPE=(ELEV2-ELEV1)/DIFF
1026 IF(JYR-NYR)803,803,802
1027 802 GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
1028 WGH=(((GHB+GHA)*.5)*((TM1-TIMEA)+ETIME))/TTIM
1029 GO TO 9001
1030 803 GHB=ELEV1+(SLOPE*(ETIME-TIMEA))
1031 GO TO 9000
1032 805 SLOPE=(ELEV2-ELEV1)/(TIMEB-TIMEA)
1033 GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
1034 IF(ETIME-TIMEA)9000,9009,9000
1035 9009 ETIME=TIMEB
1036 9000 WGH=(((GHB+GHA)*.5)*((ETIME-TIMEA))/TTIM)
1037 9001 WGHP=SGH+WGH
1038 GO TO 1006
1039 C WHEN NO RECORD IS FOUND FOR SELECTED TIME PERIOD THIS IS PRINTED IN OUTPUT
1040 85 WRITE(6,103)IWELL(I),IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
1041 103 FORMAT(' ',' WELL NO. ',I4,' NO RECORD FOR PERIOD OF ',3I3,I5,' TO
1042 1 ',3I3,I5)
1043 GO TO 1005
1044 C WHEN SELECTED TIME PERIOD STARTS BEFORE RECORDS ON TAPE THIS IS PRINTED IN
1045 C OUTPUT.
1046 86 WRITE(6,104)IWELL(I)
1047 104 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD STARTS BEFORE ACTUAL
1048 1RECORD')
1049 GO TO 1005
1050 C WHEN SELECTED TIME PERIOD GOES BEYOND RECORDS ON TAPE THIS IS PRINTED IN
1051 C OUTPUT
1052 87 WRITE(6,105)IWELL(I)
1053 105 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD BEYOND ACTUAL RECORD
1054 1')
1055 C NUMBER 99999 STORED IN WATEL (KKK) INDICATES A MISSING RECORD FOR THESE
1056 C SELECTED TIME PERIODS
1057 1005 WGHP=99999.
1058 1006 WATEL(KKK)=WGHP

```

```

1059 1000 JWELL1=IWELL(I)
1060 1110 CONTINUE
1061 107 RETURN
1062 END
1063 C
1064 C
1065 C END OF RETRIEVAL PROGRAMS, STORAGE PROGRAMS FOLLOW.
1066 C
1067 C **** STORAGE PROGRAM FOR TEST HOLE DATA ****
1068 C DEFINE FILE 1(21,1000,U,IM)
1069 C DIMENSION WELL1(1000),WELL(4),NN(4)
1070 C DIMENSION ISTART(21)
1071 C DO 105 I=1,21
1072 C 105 ISTART(I)=0
1073 C READ FROM CARD THE NUMBER OF TEST HOLE VARIABLES TO BE STORED ON DISC
1074 C READ(5,100) NOVAR
1075 C 100 FORMAT(I4)
1076 C READ A VARIABLE NUMBER, FOUR VARIABLE VALUES, AND FOUR TEST HOLE
1077 C NUMBERS FROM CARDS
1078 C 99 READ(5,200)NVAR,(NN(I),I=1,4),(WELL(I),I=1,4)
1079 C 200 FORMAT(I2,4I5,4F11.0)
1080 C IF(NVAR)4,4,1
1081 C 1 IM=NVAR
1082 C IF(ISTART(NVAR).EQ.0) GO TO 6
1083 C READ(1'IM) WELL1
1084 C IM=IM-1
1085 C GO TO 8
1086 C 6 DO 7 I=1,1000
1087 C 7 WELL1(I)=0.
1088 C 8 DO 3 I=1,4
1089 C IF(NN(I))3,3,2
1090 C 2 IW=NN(I)
1091 C WELL1(IW)=WELL(I)
1092 C 3 CONTINUE
1093 C WRITE TEST HOLE VARIABLE ON DISC
1094 C WRITE(1'IM) WELL1
1095 C ISTART(NVAR)=1
1096 C GO TO 99
1097 C WRITE TEST HOLE VARIABLE DATA FROM DISC TO TAPE
1098 C 4 IM=1
1099 C DO 5 I=1,NOVAR
1100 C READ(1'IM) WELL1
1101 C WRITE(9) WELL1
1102 C WRITE VARIABLE NUMBER, TEST HOLE NUMBER, AND VARIABLE VALUE ON PRINTER
1103 C WRITE(6,101)I,(J,WELL1(J),J=1,1000)
1104 C 101 FORMAT('0','VARIABLE NUMBER',I2,/,7(I4,2X,F11.0))
1105 C 5 CONTINUE
1106 C WRITE(6,102)
1107 C 102 FORMAT('1','TEST HOLE VARIABLE DATA HAS BEEN STORED ON TAPE')
1108 C STOP
1109 C END
1110 C
1111 C
1112 C
1113 C **** STORAGE PROGRAM FOR LAYER DATA ****
1114 C DEFINE FILE 1(1000,161,U,IM)
1115 C DIMENSION STRAT(20,8),NWELLS(1000)
1116 C NOWEL IS THE NUMBER OF TEST HOLES FOR WHICH DATA IS STORED
1117 C READ(5,100)NOWEL
1118 C 100 FORMAT(I4)
1119 C ICOUN=0
1120 C DO 3 IC=1,NOWEL
1121 C NWELL IS THE TEST HOLE NUMBER
1122 C STRAT (1,J) IS THE LAYER VARIABLES STORED IN EACH LAYER
1123 C NOLAY IS THE NUMBER OF THE LAYER FOR WHICH VARIABLES ARE STORED.
1124 C READ(5,101)NWELL,(STRAT(1,J),J=1,8),NOLAY
1125 C 101 FORMAT(I4,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6,I4)
1126 C IF(NWELL)200,200,300
1127 C 300 ICOUN=ICOUN+1
1128 C IF(NOLAY-1)3,2,1
1129 C 1 READ(5,106)((STRAT(I,J),J=1,8),I=2,NOLAY)

```



```

1130      106 FORMAT(4X,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6)
1131      2 WRITE(1,NWELL)NOLAY,STRAT
1132      NWELLS(IC)=NWELL
1133      3 CONTINUE
1134 C      SEQUENCE THE WELLS IN ASCENDING ORDER
1135      200 NUM=ICOUN-1
1136          DO 5 J=1,ICOUN
1137              DO 5 I=1,NUM
1138                  IF(NWELLS(I)-NWELLS(I+1))5,5,4
1139              4 HOLD=NWELLS(I)
1140                  NWELLS(I)=NWELLS(I+1)
1141                  NWELLS(I+1)=HOLD
1142              5 CONTINUE
1143 C      WRITE LAYER DATA ON TAPE AND PRINTER
1144          DO 7 IC=1,ICOUN
1145              IM=NWELLS(IC)
1146              READ(1,IM)NOLAY,STRAT
1147              IU=IM-1
1148              WRITE(8) IU,NOLAY,STRAT
1149              DO 6 I=1,NOLAY
1151      103 FORMAT(' ',2I5,8F10.1)
1152              7 CONTINUE
1153                  IM=0
1154                  WRITE(8)IM,NOLAY,STRAT
1155                  WRITE(6,104)
1156      104 FORMAT('1','LAYER DATA STORED ON TAPE')
1157                  STOP
1158                  END
1159 C
1160 C
1161 C      **** WATER LEVEL DATA STORAGE PROGRAM ****
1162 C      CALLS SUBROUTINE (TESTEL)
1163 C      PROGRAM STORES PUNCH CARD TAPE DOWN DATA AS WATER LEVEL ELEVATIONS ON
1164 C      MAGNETIC TAPE.
1165 C      MASTER TAPE OF WATER LEVEL ELEVATIONS IS CONSTRUCTED USING PIPE ELEVATIONS
1166 C      AND TAPE DOWN DATA STORED ON CARDS OR TAPES.
1167 C      WATER LEVEL DATA FOR SELECTED TEST HOLES CAN BE UPDATED USING THIS
1168 C      PROGRAM.
1169 C      TAPE PARAMETERS READ IN BY DATA STATEMENT
1170 C      WORDS=NUMBER OF WORDS WRITTEN PER RECORD
1171 C      LRECL=LENGTH OF RECORD SIZE
1172 C      BLKSIZ=BLOCK SIZE PARAMETER
1173 C      BPI=BITS PER INCH FOR OUTPUT TAPE
1174 C      RGAP=RECORD GAPE BETWEEN RECORDS (INCHES)
1175      REAL*4 LRECL,INPBK
1176      DIMENSION KWL(4),ELVX(4),ELVN(1000),ITEST(1000),JWELL(3)
1177      DIMENSION IWN(100),IMO(100),IDY(100),IYR(100),ELV(100)
1178      DIMENSION ITAPE(3),NMO(3),NDY(3),NYR(3),NTIM(3),EL(3)
1179      COMMON NYR,NMO,NDY,NTIM,EL,IYR,IMO,IDY,ELV,ELVN,ITEST,KTAPE,
1180      *NCODE,ICOUNT,IPAGE,IWN
1181      DATA WORDS,LRECL,BLKSIZ,BPI,RGAP/8.,24.,2400.,1600.,.75/
1182      DATA JWELL/3*0/
1183      DO 1 I=1,1000
1184          ITEST(I)=1
1185      1 ELVN(I)=0.0
1186 C      READ IN TOP OF PIPE ELEVATIONS FOR ALL TEST HOLES.
1187 C      IV=LAST CARD TEST
1188 C      KWL (I)=TEST HOLE NUMBERS.
1189 C      ELVX (I)=TOP OF PIPE ELEVATIONS AT EACH TEST HOLE.
1190      5 READ(5,1000)IV,(KWL(I),I=1,4),(ELVX(I),I=1,4)
1191      1000 FORMAT(12,4I5,4F11.2)
1192          IF(IV.LE.0) GO TO 15
1193          DO 10 I=1,4
1194              IF(KWL(I).LE.0) GO TO 10
1195              KKK=KWL(I)
1196              ELVN(KKK)=ELVX(I)
1197      10 CONTINUE
1198          GO TO 5
1199 C      READ IN PIPE ELEVATIONS CHANGES
1200      15 I=1
1201 C      IWN (I)=TEST HOLE NUMBER

```

```

1202 C      IMO (1), IDY (1), IYR (1) IS THE MONTH, DAY, AND YEAR OF PIPE ELEVATION
1203 C      (ELV (1)) CHANGES.
1204      16 READ(5,1001)IWN(1),IMO(1),IDY(1),IYR(1),ELV(1)
1205      1001 FORMAT(4I5,F10.2)
1206      IF(IWN(1).LE.0) GO TO 17
1207      ITEST(IWN(1))=0
1208      I=I+1
1209      GO TO 16
1210      17 NOBS1=1
1211 C      NTAPE=NUMBER OF TAPE DRIVE UNITS USED.
1212 C      ITAPE (1)-TAPE DRIVE UNIT NUMBERS.
1213 C      KTAPE-CREATED OR UPDATED TAPE UNIT NUMBER.
1214      READ(5,1002)NTAPE,(ITAPE(I),I=1,NTAPE),KTAPE
1215      1002 FORMAT(5I5)
1216 C      READ WELL NUMBER FROM TAPES FOR INITIALIZATION.
1217      1005 DO 1006 IT=1,NTAPE
1218          ITP=ITAPE(IT)
1219          READ(ITP,103)JWELL(IT)
1220      1006 CONTINUE
1221      1007 WRITE(6,9999)(JWELL(I),I=1,NTAPE)
1222      .9999 FORMAT('0***** ',3I10,' *****'/)
1223 C      FOLLOWING TEST STATEMENTS SELECT DATA FROM TWO OR THREE DATA SETS AND
1224 C      ARRANGES THEM IN ORDER OF ASCENDING TEST HOLE NUMBERS FOR CREATING OR
1225 C      UPDATING DATA TAPE.
1226      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 2000
1227      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).GT.0)GO TO 1060
1228      IF(JWELL(1).EQ.0.AND.JWELL(2).GT.0.AND.JWELL(3).EQ.0)GO TO 1050
1229      IF(JWELL(1).GT.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 1030
1230      IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
1231      IF(JWELL(1).EQ.0.AND.JWELL(2).LT.JWELL(3)) GO TO 1050
1232      IF(JWELL(1).EQ.0.AND.JWELL(2).GT.JWELL(3)) GO TO 1060
1233      IF(JWELL(2).EQ.0.AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
1234      IF(JWELL(2).EQ.0.AND.JWELL(1).LT.JWELL(3)) GO TO 1030
1235      IF(JWELL(2).EQ.0.AND.JWELL(1).GT.JWELL(3)) GO TO 1060
1236      IF(JWELL(3).EQ.0.AND.JWELL(1).EQ.JWELL(2)) GO TO 1010
1237      IF(JWELL(3).EQ.0.AND.JWELL(1).LT.JWELL(2)) GO TO 1030
1238      IF(JWELL(3).EQ.0.AND.JWELL(1).GT.JWELL(2)) GO TO 1050
1239      IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1009
1240      IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1010
1241      IF(JWELL(1).LT.JWELL(2).AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
1242      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1030
1243      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
1244      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1050
1245      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1030
1246      IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1030
1247      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1050
1248      IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1060
1249      WRITE(6,1008)
1250      1008 FORMAT('0','THERE ARE NO TEST COMBINATIONS FOR THESE TEST HOLES.'/)
1251      GO TO 2000
1252      1009 DO 34 IT=1,NTAPE
1253          ITP=ITAPE(IT)
1254          IF(ITAPE(IT).EQ.0) GO TO 34
1255          BACKSPACE ITP
1256          NWELL1=JWELL(ITP)
1257          20 IF(ITP.EQ.1) GO TO 21
1258          READ(ITP,103,END=30)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1259          1),I=1,3)
1260          IREAD=3
1261          103 FORMAT(14,12,3(1X,3I2,15,F7.2))
1262          GO TO 22
1263          21 READ(ITP,104,END=30)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1264          104 FORMAT(14,4I2,14,F8.2)
1265          IREAD=1
1266          22 IF(NWELL1.NE.NWELL) GO TO 25
1267          CALL TESTEL(NWELL,NOBS1,IREAD)
1268          NWELL1=NWELL
1269          GO TO 20
1270          25 JWELL(ITP)=NWELL
1271          GO TO 34
1272          30 JWELL(ITP)=0

```

```

1273     ITAPE(IT)=0
1274     34 CONTINUE
1275     GO TO 1007
1276 1010 DO 45 IT=1,2
1277     ITP=ITAPE(IT)
1278     IF(ITAPE(IT).EQ.0) GO TO 45
1279     BACKSPACE ITP
1280     NWELL1=JWELL(ITP)
1281     35 IF(ITP.EQ.1) GO TO 36
1282     READ(ITP,103,END=41)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1283     ),I=1,3)
1284     IREAD=3
1285     GO TO 37
1286     36 READ(ITP,104,END=41)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1287     IREAD=1
1288     37 IF(NWELL1.NE.NWELL) GO TO 40
1289     CALL TESTEL(NWELL,NOBS1,IREAD)
1290     NWELL1=NWELL
1291     GO TO 35
1292     40 JWELL(ITP)=NWELL
1293     GO TO 45
1294     41 JWELL(ITP)=0
1295     ITAPE(IT)=0
1296     45 CONTINUE
1297     GO TO 1007
1298 1020 DO 65 IT=1,2
1299     GO TO (50,51),IT
1300     50 ITP=ITAPE(1)
1301     IF(ITAPE(1).EQ.0)GO TO 65
1302     GO TO 52
1303     51 ITP=ITAPE(3)
1304     IF(ITAPE(3).EQ.0)GO TO 65
1305     52 BACKSPACE ITP
1306     NWELL1=JWELL(ITP)
1307     55 IF(ITP.EQ.1) GO TO 56
1308     READ(ITP,103,END=61)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1309     ),I=1,3)
1310     IREAD=3
1311     GO TO 57
1312     56 READ(ITP,104,END=61)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1313     IREAD=1
1314     57 IF(NWELL1.NE.NWELL) GO TO 60
1315     CALL TESTEL(NWELL,NOBS1,IREAD)
1316     NWELL1=NWELL
1317     GO TO 55
1318     60 JWELL(ITP)=NWELL
1319     GO TO 65
1320     61 JWELL(ITP)=0
1321     ITAPE(IT)=0
1322     65 CONTINUE
1323     GO TO 1007
1324 1030 ITP=ITAPE(1)
1325     IF(ITAPE(1).EQ.0) GO TO 1007
1326     BACKSPACE ITP
1327     NWELL1=JWELL(ITP)
1328     70 IF(ITP.EQ.1) GO TO 71
1329     READ(ITP,103,END=80)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1330     ),I=1,3)
1331     IREAD=3
1332     GO TO 72
1333     71 READ(ITP,104,END=80)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1334     IREAD=1
1335     72 IF(NWELL1.NE.NWELL) GO TO 75
1336     CALL TESTEL(NWELL,NOBS1,IREAD)
1337     NWELL1=NWELL
1338     GO TO 70
1339     75 JWELL(ITP)=NWELL
1340     GO TO 1007
1341     80 JWELL(ITP)=0
1342     ITAPE(1)=0
1343     GO TO 1007

```

```

1344 1040 DO 100 ITP=1,2
1345      GO TO(85,86),IT
1346      85 ITP=ITAPE(2)
1347          IF(ITAPE(2).EQ.0)GO TO 100
1348      GO TO 87
1349      86 ITP=ITAPE(3)
1350          IF(ITAPE(3).EQ.0)GO TO 100
1351      87 BACKSPACE ITP
1352          NWELL1=JWELL(ITP)
1353      90 IF(ITP.EQ.1) GO TO 91
1354          READ(ITP,103,END=96)NWELL,NCODE,{NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1355              1),I=1,3)
1356              IREAD=3
1357              GO TO 92
1358      91 READ(ITP,104,END=96)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1359          IREAD=1
1360      92 IF(NWELL1.NE.NWELL) GO TO 95
1361          CALL TESTEL(NWELL,NOBS1,IREAD)
1362          NWELL1=NWELL
1363      GO TO 90
1364      95 JWELL(ITP)=NWELL
1365      GO TO 100
1366      96 JWELL(ITP)=0
1367          ITAPE(ITP)=0
1368      100 CONTINUE
1369      GO TO 1007
1370 1050 ITP=ITAPE(2)
1371      IF(ITAPE(2).EQ.0)GO TO 115
1372      BACKSPACE ITP
1373      NWELL1=JWELL(ITP)
1374      105 IF(ITP.EQ.1) GO TO 106
1375          READ(ITP,103,END=111)NWELL,NCODE,{NMO(I),NDY(I),NYR(I),NTIM(I),EL(
1376              1),I=1,3)
1377              IREAD=3
1378              GO TO 107
1379      106 READ(ITP,104,END=111)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
1380          *)
1381          IREAD=1
1382      107 IF(NWELL1.NE.NWELL) GO TO 110
1383          CALL TESTEL(NWELL,NOBS1,IREAD)
1384          NWELL1=NWELL
1385      GO TO 105
1386      110 JWELL(ITP)=NWELL
1387      GO TO 115
1388      111 JWELL(ITP)=0
1389          ITAPE(ITP)=0
1390      115 CONTINUE
1391      GO TO 1007
1392 1060 ITP=ITAPE(3)
1393      IF(ITAPE(3).EQ.0)GO TO 130
1394      BACKSPACE ITP
1395      NWELL1=JWELL(ITP)
1396      120 IF(ITP.EQ.1) GO TO 121
1397          READ(ITP,103,END=126)NWELL,NCODE,{NMO(I),NDY(I),NYR(I),NTIM(I),EL(
1398              1),I=1,3)
1399              IREAD=3
1400              GO TO 122
1401      121 READ(ITP,104,END=126)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
1402          *)
1403          IREAD=1
1404      122 IF(NWELL1.NE.NWELL) GO TO 125
1405          CALL TESTEL(NWELL,NOBS1,IREAD)
1406          NWELL1=NWELL
1407      GO TO 120
1408      125 JWELL(ITP)=NWELL
1409      GO TO 130
1410      126 JWELL(ITP)=0
1411          ITAPE(ITP)=0
1412      130 CONTINUE
1413      GO TO 1007
1414 C      COMPUTES THE NUMBER OF FEET OF TAPE USED TO STORE WATER LEVEL ELEVATIONS

```

```

1415 C      AND THE NUMBER OF RECORDS STORED.
1416 2000 RECD=ICOUNT
1417      RECD=BLKSIZ/LRECL
1418      INPBK=((WORDS*BLKSIZ)/BP1)+RGAP
1419      FT=((RECD/RECD)*INPBK)/12.
1420      WRITE(6,2001) ICOUNT,KTAPE,FT
1421 2001 FORMAT('0','$$$$$ ',17,' NUMBER OF OBSERVATIONS WRITTEN ON TAPE ',12,
1422 *' $$$$$'/,6X,'FEET USED TO STORE DATA ON THIS TAPE IS ',F6.1)
1423      REWIND KTAPE
1424      STOP
1425      END
1426 C
1427 C
1428 C      SUBROUTINE TESTEL CALCULATES WATER LEVEL ELEVATIONS AND WRITES ON UPDATED
1429 C      TAPE.
1430 C      SUBROUTINE TESTEL(NWELL,NOBS1,IREAD)
1431 C      COMMON NYR(3),NMO(3),NDY(3),NTIM(3),EL(3),IYR(100),IMO(100),IDY(10
1432 10),ELV(100),ELVN(1000),ITEST(1000),KTAPE,NCODE,ICOUNT,IPAGE,IWN(10
1433 10)
1434      DO 28 I=1,IREAD
1435      IF(IREAD.EQ.1) GO TO 1000
1436      IF(NYR(I).EQ.0) GO TO 28
1437      IF(ITEST(NWELL).EQ.1) GO TO 27
1438      DO 25 J=1,NOBS1
1439 C      TEST FOR PIPE ELEVATION CHANGE
1440      IF(NYR(I).GE.IYR(J).AND.NMO(I).GE.IMO(J).AND.NDY(I).GE.IDY(J).AND.
1441 1NWELL.EQ.IWN(J)) GO TO 26
1442 25 CONTINUE
1443      GO TO 27
1444 C      NEW PIPE ELEVATION
1445 26 ELVN(NWELL)=ELV(J)
1446      ITEST(NWELL)=1
1447 C      WATER LEVEL ELEVATION CALCULATED.
1448 27 FL(I)=ELVN(NWELL)-EL(I)
1449 C      OUTPUT WRITTEN ON UPDATED TAPE
1450 1000 WRITE(KTAPE,104)NWELL,NCODE,NMO(I),NDY(I),NYR(I),NTIM(I),EL(I)
1451 104 FORMAT(I4,4I2,I4,F8.2)
1452 28 CONTINUE
1453      RETURN
1454      END
1455 C      END APPENDIX C

```

# APPENDIX D.—SOURCE LISTING FOR HYDRAULIC-COEFFICIENT RANGE-ASSIGNMENT PROGRAM

```

1      C
2      C
3      C
4      C          HYDRAULIC COEFFICIENT RANGE ASSIGNMENT PROGRAM
5      C      ***THIS PROGRAM ASSIGNS HYDRAULIC COEFFICIENT RANGE TO EACH LAYER***
6      C      THIS PROGRAM REQUIRES A SCRATCH TAPE FOR ASSIGNING CODE VALUES TO LAYER
7      C      DATA
8      C      DIMENSION A1(35),A2(15),A3(10),A4(15),STRAT(20,8),A5(15)
9      C      **THE FOLLOWING CARD READS IN THE NUMBER OF MATERIAL TYPES IN EACH RANGE**
10     READ(5,200)INO,JNO,KNO,LNO,MNO
11     200 FORMAT(5I5)
12     C      ***THE FOLLOWING CARD PUTS RANGE 1 MATERIAL INTO AN ARRAY FOR LOADING***
13     READ(5,101)(A1(I),I=1,INO)
14     C      ***THE FOLLOWING CARD PUTS RANGE 2 MATERIAL INTO AN ARRAY FOR LOADING***
15     READ(5,101)(A2(I),I=1,JNO)
16     C      ***THE FOLLOWING CARD PUTS RANGE 3 MATERIAL INTO AN ARRAY FOR LOADING***
17     READ(5,101)(A3(I),I=1,KNO)
18     C      ***THE FOLLOWING CARD PUTS RANGE 4 MATERIAL INTO AN ARRAY FOR LOADING***
19     READ(5,101)(A4(I),I=1,LNO)
20     C      ***THE FOLLOWING CARD PUTS RANGE 5 MATERIAL INTO AN ARRAY FOR LOADING***
21     READ(5,101)(A5(I),I=1,MNO)
22     101 FORMAT(10F8.0)
23     C      ***THE FOLLOWING CARD READS THE TEST HOLE NO., NO. OF LAYERS AND MATERIAL
24     C      TYPE***
25     10 READ(8,END=1001)NWELL,NOLAY,STRAT
26     DO 1000 I=1,20
27     IF (NOLAY.EQ.0)GO TO 1002
28     C      ***THIS SERIES OF TESTS MATCHES MATERIAL TYPE TO THOSE IN EACH RANGE***
29     C      ***WHEN MATERIAL TYPES MATCH THE RANGE IS ASSIGNED AND STORED ON TAPE***
30     DO 20 J=1,INO
31     IF(STRAT(I,3)-A1(J)) 20,60,20
32     20 CONTINUE
33     DO 30 J=1,JNO
34     IF(STRAT(I,3)-A2(J)) 30,70,30
35     30 CONTINUE
36     DO 40 J=1,KNO
37     IF(STRAT(I,3)-A3(J)) 40,80,40
38     40 CONTINUE
39     DO 50 J=1,LNO
40     IF(STRAT(I,3)-A4(J))50,90,50
41     50 CONTINUE
42     DO 500 J=1,MNO
43     IF(STRAT(I,3)-A5(J))500,501,500
44     500 CONTINUE
45     GO TO 1000
46     C      CODE 1.0, 2.0, 3.0, 4.0, OR 5.0 IS ASSIGNED TO
47     C      RANGE 1.0, 2.0, 3.0, 4.0, OR 5.0 RESPECTIVELY
48     C      RANGE CRITERIA IS DETAILED IN TEXT
49     60 CODE=1.0
50     GO TO 100
51     70 CODE=2.0
52     GO TO 100
53     80 CODE=3.0
54     GO TO 100
55     90 CODE=4.0
56     GO TO 100
57     501 CODE=5.0
58     100 DO 110 K=6,8
59     110 STRAT(I,K)=CODE
60     1000 CONTINUE
61     1002 WRITE(9)NWELL,NOLAY,STRAT
62     GO TO 10
63     1001 REWIND 8
64     ENDFILE 9

```

```

65      REWIND 9
66      1004 READ(9,END=1003)NWELL,NOLAY,STRAT
67      WRITE(8)NWELL,NOLAY,STRAT
68      GO TO 1004
69      1003 REWIND 8
70      WRITE(6,1005)
71  C    ***THE FOLLOWING STATEMENT INDICATES RANGES HAVE BEEN STORED ON TAPE***
72      1005 FORMAT('ODATA ON TAPE')
73      STOP
74      END
75  C

```

END APPENDIX D

## APPENDIX E.—FLOW CHARTS AND LIST OF VARIABLES FOR PREPARING GRAPHICAL PRESENTATIONS

### Flow Charts

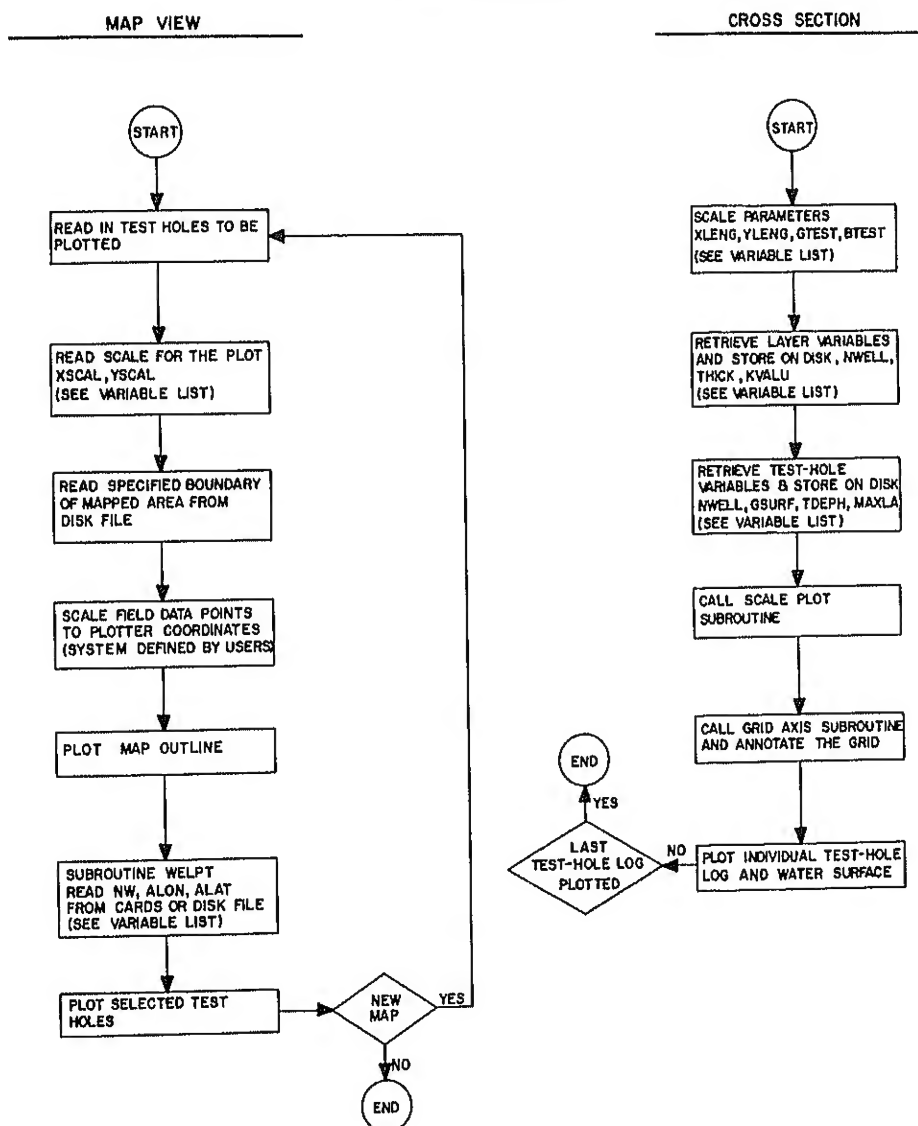


FIGURE E-1.—Flow charts for preparing map views and cross sections.

## List of Variables

<i>Variable name</i>	<i>Format</i>	<i>Description of variable</i>	<i>Variable name</i>	<i>Format</i>	<i>Description of variable</i>
Boundary Card for Cross Section			Location Card for Map Views		
XLENG	F10.0	Distance in inches between test-hole-log plots.	Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.		
YLENG	F10.0	Length in inches of the cross-section plot.	NW	F12.3	Test-hole number for each hole plotted in map view.
GTEST	F10.0	Reference ground-surface datum from which logs are measured on the plot.	ALON	F12.3	Longitude in degrees, minutes, seconds of test-hole locations.
BTEST	F10.0	Lower reference bedrock datum beneath which test-hole logs do not extend.	ALAT	F12.3	Latitude in degrees, minutes, seconds of test-hole locations.
Lithology Card for Cross Section			Lithology Card for Subdatum Map		
NWELL	I4	Test-hole numbers of logs used in cross section.	NW	I3	Test-hole number of each test hole that penetrates the specific datum plane.
IVAR	I4	Layer number for lithology of test holes in cross sections.	ISUB	I5	Elevation of the datum plane to be plotted (feet above mean sea level).
THICK	F9.1	Thickness of lithologic layers in feet.	IDEPH	I4	Depth below ground surface to the top of the lithologic layer in which specified datum plane lies.
KVALU	F9.1	Hydraulic-coefficient range (1-5) of the lithology in each layer.	ELTOP	F8.2	Elevation of the top of the lithology layer that contains the specified datum plane (feet above mean sea level).
Test-Hole Card for Cross Section			RANGE	F12.4	Range of hydraulic coefficients (1-5) at the specified datum.
NWELL	I8	Test-hole number for each log in cross section.	THICK	F12.4	Thickness in feet of the lithology layer found at the specified datum.
GSURF	F12.3	Ground-surface elevation (feet above mean sea level) for the top of each log.	DAPLT	F12.4	This variable name is assigned to the range of <i>K</i> , <i>S</i> , or <i>T</i> to be plotted.
TDEPH	F12.3	Total depth of each test hole.			
MAXLA	I2	Number of lithology layers in each test hole in cross section.			
Ground-Water-Elevation Card for Cross Section			Test-Hole Card for Map View		
HWELL	I5	Test-hole number.	Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.		
HCODE	I2	Code indicating the method of measurement of ground-water level (1=continuous recorder, 2=manual tape down).	NW	I5	Test-hole number.
NYR	I3	Year when water surface was recorded.	THVAR	F5.0	Variable THVAR may be any of the 21 test-hole variables used for plotting.
NMO	I3	Month when water surface was recorded.			
NDY	I3	Day when water surface was recorded.	Net-Thickness Card for Isopachous Map		
NTIM	I5	Time (military) when water surface was recorded.	WELL NO.	A10	Descriptive literal field.
ELEV	F8.2	Ground-water-surface elevation (feet above mean sea level) in the test hole. One card per test hole.	NW	I6	Test-hole number.
			NET THICK	A10	Descriptive literal field.
			THICK	F13.0	Net thickness in feet of lithologic layers having the selected hydraulic-coefficient ranges.



<i>Variable name</i>	<i>Format</i>	<i>Description of variable</i>	<i>Variable name</i>	<i>Format</i>	<i>Description of variable</i>
Net-thickness	Card for	Isopachous Map—Continued		Card for	Hydraulic-Coefficient Map—Continued
CODES	A6	Descriptive lateral field.	AKVAL	F5.0	Permeability averaged for all layers in the test hole, gpd/ft <sup>2</sup> of aquifer. The size of the fields containing hydraulic coefficients may be altered to accommodate retrieved data.
CODE (1)	5F4.0	Number (1–5) of the ranges of hydraulic coefficients, that is, <i>K</i> , <i>S</i> , or <i>T</i> , to be plotted.	ASVAL	F5.0	Storage coefficient, dimensionless value.
	Card for	Hydraulic-Coefficient Map	ATVAL	F11.0	Transmissibility, gpd/ft of aquifer.
NW	I4	Test-hole number.			

# APPENDIX F.—INPUT CARDS FOR GRAPHICAL PRESENTATIONS

BOUNDARY CARD FOR CROSS SECTION

VARIABLE TYPE PLOT	COLUMN					
		1-10	11-20	21-30	31-40	41-50
CROSS SECTION		X	X	X	X	
DISTRIBUTIVE MAP						
SUBDATUM MAP						
HYDR.-COEF. MAP						
ISOPACHOUS MAP						

TEST-HOLE CARD FOR CROSS SECTION

VARIABLE TYPE PLOT	COLUMN					
		1-8	9-13	14-16	17-21	22-29
CROSS SECTION		X	X	X	X	X
DISTRIBUTIVE MAP						
SUBDATUM MAP						
HYDR.-COEF. MAP						
ISOPACHOUS MAP						

LITHOLOGY CARD FOR CROSS SECTION

VARIABLE TYPE PLOT	COLUMN					
		1-4	5-8	9-18	19-23	24-29
CROSS SECTION		X	X	X	X	
DISTRIBUTIVE MAP						
SUBDATUM MAP						
HYDR.-COEF. MAP						
ISOPACHOUS MAP						

GROUND-WATER-ELEVATION CARD FOR CROSS SECTION

VARIABLE TYPE PLOT	COLUMN					
		1-5	6-7	8-10	11-13	14-16
CROSS SECTION		X	X	X	X	X
DISTRIBUTIVE MAP						
SUBDATUM MAP						
HYDR.-COEF. MAP						
ISOPACHOUS MAP						

GROUND-WATER ELEVATIONS IN  
EXAMPLE PLOT WERE RETRIEVED  
FROM MAGNETIC TAPE STORAGE FOR  
USE AS CARD INPUT TO PLOTTER  
PROGRAMS

BLANK CARD FOR CROSS SECTION  
USED IN CROSS-SECTION PLOT ONLY

VARIABLE TYPE PLOT	COLUMN					
		1-10	11-20	21-30	31-40	41-50
CROSS SECTION						
DISTRIBUTIVE MAP						
SUBDATUM MAP						
HYDR.-COEF. MAP						
ISOPACHOUS MAP						

BLANK CARD INDICATES END  
OF LITHOLOGIC DATA AND  
START OF TEST-HOLE DATA

Figure F-1.—Input cards for plotting cross sections.

LOCATION CARD FOR MAP VIEW

VARIABLE TYPE PLOT

COLUMN

ISTOR(1) WEST HOLE

1-12

ISTOR(4) LONGITUDE

13-24

ISTOR(3) LATITUDE

25-36

CROSS SECTION

DISTRIBUTIVE MAP

SUBDATUM MAP

HYDR.-COEF. MAP

ISOPACHOUS MAP

CARD CONTAINS TEST-HOLE-NUMBER LONGITUDE AND LATITUDE OF EACH DATA POINT

NET-THICKNESS CARD

VARIABLE TYPE PLOT

COLUMN

WELL NO.

1-10

NM

11-16

NET THICK

17-26

THICK

27-39

CODES

40-45

CODE(1)

52-55

CODE(2)

56-59

CODE(3)

60-63

CODE(4)

64-67

CODE(5)

68-71

RANGES 1, 2, 3, 4, AND 5, ARE USED IN THIS EXAMPLE

HYDRAULIC-COEFFICIENT CARD

VARIABLE TYPE PLOT

COLUMN

NM

1-4

AKVAL

5-9

ASVAL

10-14

ATVAL

15-25

CROSS SECTION

DISTRIBUTIVE MAP

SUBDATUM MAP

HYDR.-COEF. MAP

ISOPACHOUS MAP

FIELDS ON THIS CARD MAY BE VARIED TO FIT DATA ATVAL NOT USED IN THE SAMPLE

LITHOLOGY CARD FOR SUBDATUM MAP

VARIABLE TYPE PLOT

COLUMN

NM

1-3

ISUB

4-8

IDEPH

9-12

ELTOP

13-20

RANGE

21-32

THICK

33-44

DAPLT

45-56

CROSS SECTION

DISTRIBUTIVE MAP

SUBDATUM MAP

HYDR.-COEF. MAP

ISOPACHOUS MAP

TEST-HOLE CARD FOR MAP VIEW

VARIABLE TYPE PLOT

COLUMN

ISTOR(2) TEST HOLE

1-5

ISTOR(1) 6-10

CROSS SECTION

DISTRIBUTIVE MAP

SUBDATUM MAP

HYDR.-COEF. MAP

ISOPACHOUS MAP

THE VARIABLE ISTOR(1) MAY BE ANY OF THE 21 TEST-HOLE VARIABLES DESCRIBED PREVIOUSLY

FIGURE F-2.—Input cards for plotting map views.

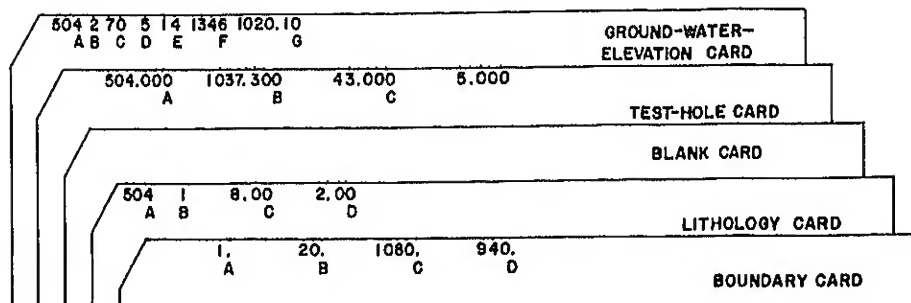


FIGURE F-3.—Input-card setup for plotting cross sections.

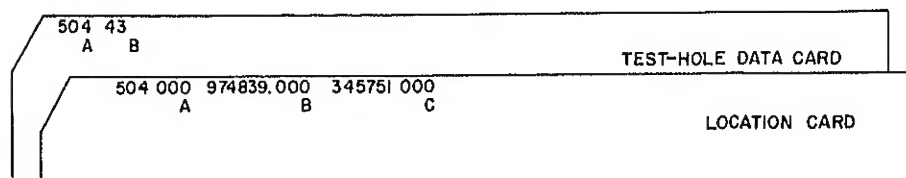


FIGURE F-4.—Input-card setup for plotting test-hole data (see figure 10).

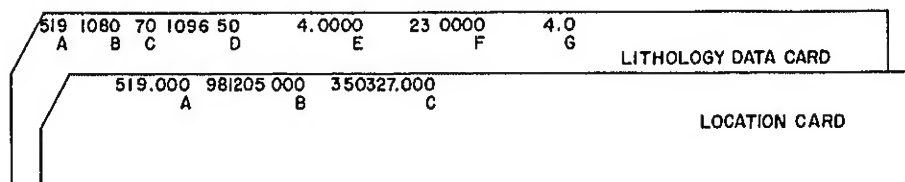


FIGURE F-5.—Input-card setup for plotting data at a specified subdatum (see figure 12).

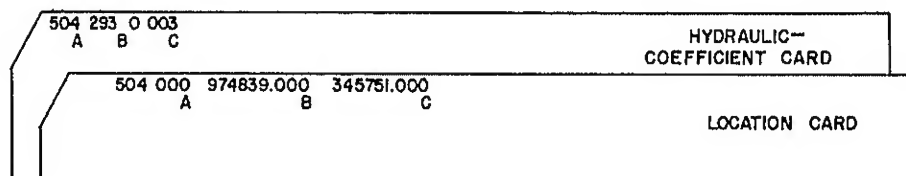


FIGURE F-6.—Input-card setup for plotting average permeability coefficients (see figure 14).

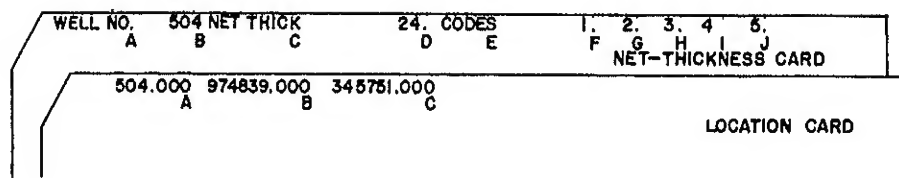


FIGURE F-7.—Input card setup for isopachous maps (see figure 16).

---

TRADE NAMES ARE USED IN THIS PUBLICATION SOLELY FOR THE PURPOSE OF PROVIDING SPECIFIC INFORMATION. MENTION OF A TRADE NAME DOES NOT CONSTITUTE A GUARANTEE OR WARRANTY OF THE PRODUCT BY THE U.S. DEPARTMENT OF AGRICULTURE OR AN ENDORSEMENT BY THE DEPARTMENT OVER OTHER PRODUCTS NOT MENTIONED

---

\*1976-G.P.O.-1750-S/771-040/5